



22  
D. Humphreys Store

Purchased at the Sale of the Library of  
Dr. Bean -











1770  
Stones.

A

C O U R S E  
O F  
Anatomico-Physiological  
L E C T U R E S  
O N T H E  
H U M A N S T R U C T U R E  
A N D  
A N I M A L O E C O N O M Y ;

Interperfed with  
Various Critical NOTES, extracted from Memoirs,  
Transactions of Learned SOCIETIES, &c. and  
Pathological Observations deduced from the  
Dissection of morbid Bodies.

I N C L U D I N G  
Whatever is most valuable in the WORKS of all  
the eminent PROFESSORS on these Subjects.

P A R T I C U L A R L Y  
WINSLOW, HALLER, RUYSCH, MORGAGN,  
MONRO, HEISTER.

Illustrated with  
An HISTORICAL COMPENDIUM of the Rise, Progress, and  
Discoveries, which have been made in the ANIMAL  
OECONOMY, gradually traced to the present Time.

To which are prefixed,  
TWO ESSAYS on the ARTS of Dissecting, Injecting and  
Making ANATOMICAL PREPARATIONS.

---

V O L. I.

---

*Omne tulit punctum, qui miscuit utile dulci.*      HOR.

---

By CHARLES NICHOLAS JENTY, M.A.  
Professor of ANATOMY and SURGERY.

---

L O N D O N,  
Printed for JAMES RIVINGTON and JAMES FLETCHER, at the  
Oxford Theatre in Pater-Noster-Row. MDCCLVIII.

*Now published by the same* AUTHOR,  
Dedicated to the Worshipful Company  
of SURGEONS,

A N

Anatomical Demonstration  
OF THE  
HUMAN STRUCTURE,

In four TABLES half as large as NATURE.

From the PICTURES painted after Dissections, for that Purpose,

By Mr. VAN RIEMSDYK.

Disposed in such a Manner, as to represent gradually all the distinct Parts of the Human Body in their Natural Situation, as they appear in DISSECTION, with all the Capital Nerves, Veins, and Arteries, when injected; so contrived as to convey a clearer Idea of the ANIMAL OECONOMY than has yet appeared in any other Anatomical Figures.

As it may, perhaps, be imagined by some, that it is impossible to express all the different Parts of the Human Structure, in these *Four Tables*; to obviate this Objection, it must be observed, that all the useless and perplexing Repetitions, usually met with in Figures of this Kind, are entirely avoided.

The TABLES are done in the Mezzotinto, being the best Means to imitate Nature, when coloured.

N. B. These PICTURES have been laid before the ROYAL SOCIETY, by whom they were looked upon as the most accurate of the Kind that ever appeared.

To the Right Honourable the  
Earl of MACCLESFIELD,  
P R E S I D E N T,  
A N D T O T H E  
C O U N C I L  
A N D  
M E M B E R S  
O F T H E  
ROYAL SOCIETY of LONDON,

T H I S  
Course of Anatomico-Physiological Lectures  
on the Human Structure and Animal Oeco-  
nomy is humbly dedicated by their

most obedient, and most

humble Servant,

LONDON,  
June 30, 1757.

Charles Nicholas Jenty.

Digitized by the Internet Archive  
in 2011 with funding from  
Open Knowledge Commons and Harvard Medical School



# P R E F A C E.

**I** Think it will not be improper to give a concise Account of the following Lectures, and my Motives for publishing them.

I am not insensible that such a Task as this might have been executed much better by Men of superior Abilities, but it seems their Occupations either in teaching Anatomy, Practice, &c. engross so much of their Time, that they have no Leisure for it; and as they have long publicly declared and wished that some Gentleman or other would take upon him the Pains to form a System of Anatomy interspersed with Physiological and Pathological Observations adapted to the Improvements that have been made of late in the Knowledge of the animal Oeconomy.

And tho' these Subjects have been learnedly treated of separately by various Authors, but not disposed in so instructive a Manner as one could have wished, for the Benefit of TYROS.

On these Considerations, after having perused many Authors in order to form these Lectures,

however, following no Authors but such only as were most agreeable to Nature, amongst whom, I found none that had given a more exact Account of the human Structure and animal Oeconomy than the Professors WINSLOW, HALLER, MORGAGNUS, ALBINUS, &c. I freely confess what Knowledge I have of the human Body is in a great Measure owing to the Lectures or Writings of the above Gentlemen, corroborated by the Dissection of a considerable Number of human Subjects.

WINSLOW's Anatomy has been looked upon by the learned World as the most accurate hitherto published, altho' some Anatomists endeavour to point out Mistakes in his Works which I believe no judicious Man can really attribute to his Ignorance of the Parts; for I may venture to say no Man before him has taken more Pains and made more Proficiency in the animal Oeconomy than he has.

It is true that in some Parts of his Work he gives a very minute Description of the human Structure, (which perhaps might appear useless to many,) and sometimes is too concise; he also uses Repetitions which may be very useful in refreshing the Memory in a publick Course of Lectures, but not so agreeable in Reading.

As the Basis of this Work is partly founded on his Writings, and those of the learned and ingenious Professor HALLER, whose Works being so well known, need not any Encomium, having been always esteemed the best



Collection of Phyfiological Effays that ever has been published, tho' diffused, in such a Manner, that some might have been base enough, to publish them for their own Productions. At the End of each Lecture, I add Pathological and Anatomical Observations adapted to it; having also inserted various Opinions as were thought the most plausible, in former Times, nay some even now subsisting on the most obscure Subjects in the animal Oeconomy, which now are exploded to prevent Beginners from falling into the same Error; various critical Notes are dispersed in these Lectures, in some of which perhaps I may have omitted the Authors Names (particularly the ingenious MONRO, on the Bones in Vol. I.) as it is not always possible for a Man to remember exactly from whom he has taken his Observations. I would therefore desire the Reader not to think that I did this with an Intention of exhibiting them as my own, but attribute them to the right Owner; and if, in the Course of this Work, any Observations should occur, which have not been made by any Author, (that they may not go without a Name) I am willing they should be attributed to me.

I have been as careful as possible not to lay down any Thing as a Principle, which to me seemed doubtful, or had not proper Authority or Experiments to support it. I have chosen rather to follow the Opinions of the above learned Professors, than to introduce any Innovations of my own, which are not duly supported by Experience.

In the Historical Compendium there are no Authors inserted, but such have, or at least endeavoured to make farther Discoveries in the animal Oeconomy; and I hope the short Account of their Works and Editions (so far as they came to my Knowledge) and the synoptical Exposition of the Human Structure, being an Essay on the Art of Dissecting, with that of Injection and making Anatomical Preparations, will not be unacceptable to Beginners.

In the Course of this Work, the Reader will find that I have been at the Pains of perusing above two hundred Authors with various Memoirs and Transactions of learned Societies. *In hoc gaudeo aliquid discere, ut doceam.* SENECA. With Regard to the Usefulness of Anatomy, it is so universally known, that it will be of very little Signification, to pretend to say any Thing about it, except I should take upon me to write a Panegyrick on the Subject.

Wherefore the only Means to obtain the Knowledge of the animal Mechanism, that I know of, and universally acknowledged to be by dissecting and making Experiments on various Creatures, tho' I would recommend Gentlemen by all Means not to meddle with any other Subjects than Human ones, till they have attained a competent Knowledge of our own Species, not as commonly practised; that is, Gentlemen think when they have attended a Course of Lectures, and dissected a Subject or two, they have completed their anatomical Studies, but this Proceeding is a mere  
 Illu-

Illusion ; therefore I shall take the Liberty to lay down the Method which I follow ; that is, when a Gentleman enters with me, first of all I give a compendious Theory of the Parts, without detaining him too long on the Bones as is commonly practised, and show him how to dissect not suffering him to remove any Parts till I have fully explained them, and he has acquired a competent Knowledge of the same ; for it is well known that it is not by the Number of Subjects a Gentleman dissects, that he attains the true Knowledge of the Structure, but by the Care and judicious Instructions he receives of the Parts as they lie in their natural Situation, and removing them afterwards for farther Examination so on gradually to the Bones, and always pay Regard to the dry Skeleton for the better understanding how the Parts are fixed, and give Motion to our Machine.

Likewise the common Method of teaching the sanguiferous Vessels and the Nerves on too small a Subject, especially the former ; I think is no further useful, than to give a general Idea of their Distribution ; but as these Vessels are considerably smaller than in Adults, and as Chirurgical Operations are not so frequently performed upon Children than on grown Persons, methinks (and I know it by Experience) that Gentlemen often commit great Mistakes in Practice, from the Idea they have retained, of the Smalness of the Vessels in Children in Comparison with those of an Adult.

I have contrived a Syringe with proper Pipes in such a Manner, that a Gentleman may himself, without further Assistance, inject all the capital Arteries of an adult Subject at once.

Tho' I have been reading English Authors for these dozen Years past, and understand the Language sufficiently to come at the Sense, nevertheless I am conscious that these Lectures are not so well penned, as if they came from an English Hand; but I must crave the Privileges which are allowed to Men who write on any Art or Science in a foreign Language, that is, that the Intention, not the Style, of the Writer be regarded.



# CONTENTS

OF THE

## LECTURES

OF

### VOL. I.



**A**N HISTORICAL COMPENDIUM of the Origin, Progress, and Discoveries that have been made in Anatomy and Physiology, from the earliest Time, this Art was first cultivated, gradually to the present Age. Page xvii

ESSAYS on the Art of preparing and preserving the Parts of human Bodies; with that of Injecting their Vessels, according to Professor MONRO's Method. clxvii

A SYNOPSISAL EXPOSITION of the Parts of the HUMAN BODY, as they are gradually met with in Dissection. clxxxiii

LECT. Page

I. **O**F ANTHROPOSOLOGY. I

II. Of OSTEOGENY, or the NATURE and GENERATION of the BONES. 14

III. Of the Division of the BONES. 61

IV. Of SYNOSTEOGRAPHY: Or, the Connexion of the Bones by Means of their natural Ligaments. 69

V. Of

# C O N T E N T S.

LECT.	Page
V. Of OSTEOGRAPHY: Or, the Description of the BONES in particular.	73
VI. Of the BONES of the TRUNK.	106
VII. Of the THORAX.	130
VIII. Of the CARTILAGES and LIGAMENTS of the TRUNK.	151
IX. Of the SUPERIOR EXTREMITIES.	170
X. Of the CARTILAGES and LIGAMENTS of the SUPERIOR EXTREMITIES.	193
XI. Of the INFERIOR EXTREMITIES.	211
XII. Of the CARTILAGES and LIGAMENTS of the INFERIOR EXTREMITIES.	233
XIII. Of SARCOGRAPHY.	261
XIV. Of the MYOLOGY.	298
XV. Of the MUSCULAR ACTIONS.	326
XVI. Of the MUSCLES of the FACE and INFERIOR MAXILLA.	342
XVII. Of the ABDOMINAL MUSCLES.	371
XVIII. Of the Nature of the BLOOD of the human Body.	388





# CONTENTS

OF THE

## LECTURES.

OF

VOL. II.

**A**N INTRODUCTORY LECTURE on the SE-  
CRETIONS. Page i

LECT.

I. Of the PERITONÆUM and EPIPLOON.	1
II. Of the OESOPHAGUS and VENTRICULUS.	18
III. Of the general Situation and Division of the INTESTINES.	39
IV. Of the MESENTERIUM, MESO-COLON, &c.	65
V. Of HUNGER, THIRST, FOOD, and DRINK.	80
VI. Of the Nature of the CHYLE.	92
VII. Of the LIVER.	108
VIII. Of the PANCREAS, &c.	133
IX. Of the SPLEEN.	138
X. Particular Remarks, Description, and Uses, of the INTESTINES and DUODENUM.	158
XI. Of the RENES, or KIDNEYS.	172
XII. Of the URINARY BLADDER.	203
XIII. Of the Organs of Man subservient to GE- NERATION.	221

XIV. Of

# C O N T E N T S.

LECT.	Page
XIV. Of those of Females.	257
XV. Of the CATAMENIA, or MENSES.	290
XVI. Various Opinions, both of the Antients and Moderns, concerning the GENERATION of our Species.	306
XVII. Of CONCEPTION.	324
XVIII. Of the FOETUS IN UTERO, its Accretion, Nutrition, &c.	344
XIX. Of the GRAVID UTERUS, and the Ex- clusion of the FOETUS.	375
XX. Of the MAMMÆ, or BREASTS.	395
XXI. Of the PLEURA, HEART, and its Ap- pendages.	419
XXII. Of the SYSTOLE and DIASTOLE of the HEART.	450
XXIII. Of the Force of the HEART, Contraction of the ARTERIES, &c.	473
XXIV. Of the PULMONES, and their Appen- dages.	509
XXV. Of RESPIRATION and EXPIRATION, &c.	538







# CONTENTS

OF THE

## LECTURES

OF

VOL. III.

LECT.	Page
I. OF the LIPS, MOUTH, and GUMS.	1
II. Of the TONGUE.	16
III. Of the SALIVAL GLANDS, and the ORGANS of SMELLING.	41
IV. Of the ORGANS of HEARING.	60
V. Of the ORGANS of SIGHT.	84
VI. Of VISION.	120
VII. Of the BRAIN and its Appendages.	145
VIII. Of the Sanguiferous Vessels of the BRAIN and MEDULLA SPINALIS, with their Uses.	181
IX. Of the Office of the BRAIN.	205
X. Of the Muscles which move the BONES of the SHOULDER on the TRUNK, and the HUMERUS upon the SCAPULA.	225
XI. Of the Uses of the MUSCLES which move the BONES of the SHOULDER on the TRUNK, and the HUMERUS upon the SCAPULA.	245
XII. Of the MUSCLES which move the BONES of the FORE-ARM on the HUMERUS and the RA- DIUS on the ULNA.	262
XIII. Of the MUSCLES which move the CARPUS upon	

# C O N T E N T S.

LECT.	Page
upon the FORE-ARM, the Bones of the METACARPUS, and those of the FINGERS.	278
XIV. Of the MUSCLES which move the HEAD, TRUNK, and NECK.	310
XV. Of the MUSCLES of the BACK, LOINS, and Os COCCYGIS.	331
XVI. Of the MUSCLES which move the FEMUR on the PELVIS and the LEG on the Os FEMORIS.	345
XVII. Of the MUSCLES which move the TARSUS on the LEG, METATARSUS, and TOES.	376
XVIII. ANGIOGRAPHY of the Arteries.	402
XIX. ANGIOGRAPHY of the ARTERIES continued.	430
XX. ANGIOGRAPHY of the Veins.	452
XXI. ANGIOGRAPHY of the VEINS continued.	471
XXII. NEUROLOGY.	493
XXIII. NEUROGRAPHY.	527
XXIV. NEUROGRAPHY continued.	560
XXV. NEUROGRAPHY continued.	585

---

\* \* Among the Errors of the Press, which pervert the Sense.  
V O L. I.

P. 4. l. 32. Scisfores, *read* Incisfores.

233. l. 2. Superior Extremity, *read* Inferior.

372. l. 6. Obliquus Externus, or Ascendens, *read* or Descendens.

376. l. 14. Obliquus internus or Descendens, *read* or Ascendens.



A N  
HISTORICAL COMPENDIUM  
OF THE

Origin, Progress, *and* Discoveries,

That have been made in

ANATOMY *and* PHYSIOLOGY,

FROM

The earliest Time this Art was first cultivated,  
gradually to our present Age.



WITH Respect to the Antiquity of ANATOMY, it seems scarcely possible but that the Slaughter of Beasts for the Use of Man, Casualties, Murders, and the Accidents of War, must have furnished Mankind with a general Knowledge of the Structure of the Parts in very early Ages of the World; but it is not very certain, at what Period it began to be cultivated as a Science.

This, however, must have been very early, especially if we pay any Regard to MANETHO, the famous Egyptian Writer; who, according to the

## xviii An Historical Compendium.

Report of EUSEBIUS, relates, That ATHOTIS, an Egyptian King, wrote some Treatises of Anatomy. This King, if the Egyptian Chronology was to be depended on, lived many Ages before ADAM. This, how ever false, with Respect to Time, amounts to a Sort of Proof of the Antiquity of the Science I am speaking of.

It is very certain, that before, or at least in, the Days of HOMER, Anatomy was much cultivated; since this Author appears to have had a competent Knowledge of the Parts, and to have been very well skilled in the Renunciation of Wounds, as the Moderns call it, so as to be able to give an accurate Account of their Effects, in almost all Parts of the Body.

But HIPPOCRATES is the first Author, at least extant, who has treated of Anatomy scientifically.

This Divine Writer, conscious of his noble and exalted Genius, published many anatomical Observations, which, tho' incongruous and scattered here and there in his Works, yet make up an entire Body of Anatomy, when taken together. But that he made it his principal Study to understand and explain the Bones of the human Body, is plain, from those valuable and well-wrote Books upon Fractures and the Joints, which evidently discover his perfect Knowledge of, and intimate Acquaintance with, the Bones; and, that his Diligence, Industry, and Skill, in this Way, might the more effectually be transmitted to future Ages, he consecrated (if we may believe PAUSANIAS) a brazen Skeleton to the Delphian APOLLO.

The Writings of this great Man are interspersed with many Things relating to the Blood; which, as they seem to shew his Knowledge of its Circulation, and also of the Secretions of the Humours, Dr. DOUGLAS has pointed out such of them as  
seem

seem to be the most convincing and unexceptionable Proofs of this Point.

It cannot be doubted but HIPPOCRATES and the Antients knew that the Blood circulated ; but it is certain they did not know how, or in what Manner, the Circulation was performed.

LE CLERC is far from thinking, with Dr. DOUGLAS, that all the anatomical Observations, dispersed in the Works of HIPPOCRATES, amount to an entire System. He says, that it is no easy Task to give a just Extract of the Anatomy of HIPPOCRATES. Three Things concur to deprive us of the Light that were to be desired in this Point. In the first Place, there are several Contradictions in what HIPPOCRATES has wrote upon this Subject, or, rather, in the Books ascribed to him as their Author. Secondly, Tho' one should collect all that he has said concerning each Part, yet still it would amount to nothing complete or coherent. In fine, though so many Faults had not crept into the Text, or though there were less Variety in the original Manuscripts ; yet his Style is so concise, and some Passages in him are so obscure, and conceived in Terms so peculiar to himself, that it is not always easy, even for the greatest Masters of the Greek Language, to comprehend his Meaning.

For these Reasons, one might justly lament the Loss of a Book wrote by GALEN on the Anatomy of HIPPOCRATES, were not this Author to be suspected, on Account of his Partiality, with Regard to that antient Physician : Instances of which, even in Point of Anatomy, are to be met with.

The Assistance which, upon this Occasion, one might expect from Translators and modern Commentators, is also very inconsiderable : If any Light is to be got from them, we ought to depend less upon these of the present, than those of pre-

## xx An Historical Compendium.

ceding Ages; since it is to be feared, that the former, full of their new Discoveries, imagine they see them every-where; falling into the like ridiculous Error with those who find in HOMER the most exquisite Delicacies, and refined Improvements, of all the Arts and Sciences; or into the still more unaccountable Enthusiasm of others, who find the Philosophers Stone in all the Books of the Antients, whatever the Subject handled should happen to be.

DEMETRIUS was cotemporary with HIPPOCRATES: With Respect to his Knowledge of Anatomy, we learn no more, than that, when the People of Abdera called HIPPOCRATES to cure him of a supposed Madness, this Physician found him dissecting Animals, in order to discover the Cause of Diseases, which, he apprehended, had its Residence in the Bile: Upon which, HIPPOCRATES reported, to those who employed him, that DEMOCRITUS was not only in his Senses, but was the wisest of Men.

DIODEGENES LAERTIUS gives the Title of a Book wrote by DEMOCRITUS, which should seem to be anatomical, as it is of the Nature of Man, or of the Flesh.

PYTHAGORAS, according to the Report of the same DIODEGENES LAERTIUS, had some crude Notions of Anatomy, which are not of Importance enough to relate, since they are drawn from Speculation, more than Reality.

EMPEDOCLES, a Pupil of PYTHAGORAS, as we learn from GALEN, had some very singular Notions of the Structure and Uses of the Parts of Animals: For he imagined, that certain particular Parts of their Bodies were contained in the Seed of the Male, and others in that of the Female; and that, from this Circumstance, the venereal Desires of both Sexes were to be accounted for:

Foolishly

Foolishly imagining, that the Parts, thus separated, had a natural Tendency to join, and be again united with, each other. With Regard to Respiration, he thought it was performed in this Manner: “ As soon, says he, as that Humidity, “ of which there is great Store on the first Formation of the Foetus, begins to be diminished, “ the Air, insinuating itself thro’ the Pores of the “ Body, succeeds it; after that, the natural Heat, “ by its Tendency to make its Escape, drives the “ Air out; and, when this natural Heat enters the “ Body again, the Air follows it afresh. The “ former of these Actions is called Inspiration, and “ the latter Expiration.” The Foetus, according to this Philosopher, respired in the Uterus.

The Sense of Hearing was, according to him, excited by the Air striking on the internal Side of the Ear, which is wreathed in Form of a Shell, and fixed to the most elevated Part of the Body, as it were like a small Bell, which was sensible of all the Undulations and Impulses of the Air which should enter it.

The Flesh was, according to him, composed of an equal Portion of the four Elements; the Nerves consisted of Fire, Earth, and two Parts of Water; the Nails were formed by the Extremities of the Nerves, cooled and hardened by their Contact with the ambient Air: The Bones appeared to him to be composed of equal Parts of Water and Earth; or at least he thought that these two Elements predominated over the other two in their Composition: Sweat and Tears he took to be Blood attenuated, and rendered thin.

The Seeds of Plants he esteemed analogous to the Eggs of Animals, which drop at the Time of their Maturity.

ALCMÆON, of Crotona, who was also a Disciple of PYTHAGORAS, deserves to have his Name

## xxii An Historical Compendium.

handed down to future Ages, if (as CHALCIDIUS, in his Commentaries upon the Timæus of PLATO, assures us,) he was the first who dissected Animals, in order to know the Parts of which their Bodies consist: But, Time having robbed us of his Writings, we know no more of his Anatomy than what we find in some antient Authors; and even what we meet with in them seems rather to relate to Physiology, than Anatomy. He imagined, that the Sense of Hearing was occasioned by the Ear's being concave within; and that all hollow Places resound when any Sound entered them; and that Goats breathed partly by their Ears.

With Regard to the Sense of Smelling, he maintained, that the Soul, of which the principal Part is, according to him, lodged in the Brain, received the Odours drawn in, in Respiration. He imagined, that the Tongue distinguished Tastes by its Humidity, moderate Heat, and Softness; he thought the Seed was a Part of the Brain, and that the Fœtus was nourished in the Womb by drawing a Supply at all the Parts of the Body, which is externally porous like a Sponge.

Health, in his Opinion, depends on the Equality of Heat and Driness, Coldness and Humidity, and even of Sweetness and Bitterness, and other sensible Qualities. Maladies, on the other Hand, he thought arose when one of these Qualities predominated, and, by that means, broke the Union and Connexion.

That ARISTOTLE applied himself diligently to anatomical Studies, is sufficiently plain, from his Writings; for they abundantly convince us, that he does not relate every Thing on the Authority of others, but that he was an immediate Spectator of them; though, in his Days, Dissections of the human Body were very rare and uncommon. It must, however, be owned, that he borrowed  
many



many Things from HIPPOCRATES, which will not fail to appear, upon comparing the two Authors together: But HIERON MERCURIALIS affirms, without Reason, that he borrowed all his Sentiments on Anatomy from others.

ALEXANDER THE GREAT, whose Preceptor ARISTOTLE was, being desirous to know the Nature and different Properties of Animals, ordered him to bend his Thoughts that Way; and, for that Purpose, furnished him with Eight Hundred Talents, which amount to about a Hundred and Fifty-five Thousand Pounds Sterling: That Prince supplied him also with several Thousands of Men from the different Quarters of Greece and Asia, who had Orders to obey him, to communicate to him all they had learned from Hunting and Fishing, and even to nourish and bring up all Sorts of Animals, with no other View but to discover the Peculiarities of each Species, and communicate them to him.

One might justly think, that, with so considerable Assistances, ARISTOTLE should not have failed to produce something very exact and accurate upon this Subject; and yet even the Antients observed, that he had advanced several Things contrary to Truth.

He may be excused in this Point, by saying, that, in this Case, he was obliged to rely on the Authority of others, since he could not possibly see and do every Thing himself. But suppose he had been obliged, on some Occasions, to rely on the Relations and Accounts of Men; for Instance, in what relates to certain Properties of Animals discovered by Chance; yet there are other Occasions, on which he must have been an Operator himself, or, at least, must have been present, and given Directions to others. Of this Kind are the Things relating to Anatomy. What Opinion,

## xxiv An Historical Compendium.

then, must we have of the Accuracy of this Philosopher, when we find him maintaining, that all Animals have their Necks flexible, and consisting of Vertebræ, except Wolves and Lions, whose Necks, he says, consist of one Bone? What Notion shall we also entertain of him, when he assures us, that the Bones of Lions contain no Marrow? A Thing contrary to all the Experiments which have hitherto been made.

The Curious may consult the learned BORICHIUS, with regard to the other Errors into which ARISTOTLE has fallen in respect of the Anatomy of the Lion, Eagle, and Crocodile: However, he has had Errors laid to his Charge, which he never was guilty of.

He looked upon the Heart as the Source and Principle of the Veins and Blood. “The Blood,” says he, passes from the Heart into the Veins;” but he says, that it comes from no Part to the Heart. He moreover maintained, that two Veins proceeded from the Heart; one from the right Side, which is the larger; the other from the left, which is lesser, and which he called the Aorta.

It is proper to observe here, that this Philosopher, according to GALEN\*, was the first who gave this Name to the great Artery; which proves that HIPPOCRATES’s fourth Book DeCorde, where this Word is found, was not wrote by him.

He thought that these two Veins conveyed the Blood to all the Parts of the Body; he also imagined, that there were three Cavities in the Heart, which he calls Ventricles. Of these three, that in the Middle, the precise Situation of which he does not determine, is, according to him, the common Principle of all the rest, though it be the

---

\* De Venar. & Arteriar. Dissect.

smallest; the Blood, which it contains, is also the most temperate, and pure: The Blood of the right Ventricle is warmest, that of the left coldest; and this last is the largest of the three. They all have a Communication with the Lungs by Vessels which are quite different from the two great Veins already mentioned, which Vessels distribute themselves through all the Substance of the Lungs.

This Philosopher not only made the Veins or Blood Vessels, but also the Nerves, to derive their Origin from the Heart; and he founded his Opinion upon this, that the largest of the Ventricles of the Heart contains small Nerves: The Vein which he calls the Aorta is nervous, and itself like a true Nerve towards its Extremities, since it has no Cavity, and is stretched out in the same Manner with Nerves, where it terminates near the Articulations of the Bones.

He also maintains, that there are Numbers of Nerves in the Heart, and they are of singular Use there, since its Contraction and Dilatation depend upon them: But he seems, in this last Passage, to mean the Tendons or Fibres which contract and dilate the Heart. And if HIPPOCRATES confounded the Nerves with the Tendons and Ligaments; it does not appear that ARISTOTLE distinguished these Parts better, nor that he knew the Use of the real Nerves. For he maintains, that the Nerves are not continued like the Veins; but that they are scattered here and there, and distributed to the Parts where the Articulations are: By which it is plain, that he still means the Tendons. If he had understood the Use of the Nerves, he had never asserted, in another Passage, that no Parts, but such as contain Blood, were capable of Sensation: And he would never have maintained, as he does, that the Flesh is the proper Organ of Sensation. As for Motion, if he  
ascribes

ascribes it to the Nerves, it is evident, that the Nerves he means are also Tendons or Ligaments.

The common Principle of Motion and Sensation is, according to ARISTOTLE, lodged in the Heart, which he also makes to be the Principle of Nourishment to the whole Body, by the Blood which it sends to all its Parts. It contains the natural Fire, is the Seat of the Passions, the Point, as it were, in which all the Sensations terminate, as in a common Center, and the true Seat of the Soul; and all this, not because the Nerves draw their Origin from it, as one might be induced to think, by what has been said; but because the Heart is the Reservoir, or Storehouse, of the Blood and Spirits.

ARISTOTLE even maintains, in plain Terms, that the Spirits cannot be contained in the Nerves.

But if he ascribed such noble Uses to the Heart, he imagined, that the Brain was only a Mass of Earth and Water, void of Blood, and destitute of Sensation. “The Office of this cold Mass was,” says he, to balance and correct the Heat of the “Heart:” But, besides his ascribing this Office elsewhere to the Lungs, he does not specify the Manner in which he imagined the Brain could answer this End. Though the Brain be placed immediately above the Medulla Spinalis, and is joined with it; yet ARISTOTLE imagined, that this Marrow was quite a different Substance from that of the Brain, being only a Species of Blood prepared for the Nourishment of the Bones; and, consequently, hot: Whereas the Brain was, in his Opinion, very cold. Besides, he thought the Brain of so little Importance, as to place it only next in Rank to the Excrements; and imagined, that it ought not to be ranked among the Parts of the Body, which are united and connected with one another: But that it ought to be looked upon as a  
Sub-

Substance of a particular Nature, quite different from all the rest of the Parts.

With Regard to the other Viscera, such as the Liver, Spleen, and Kidneys; he imagined, that their principal Use was, to support the Veins, which, without them, would be loose and pendent, and to fix them in their proper Places. Besides this general Use, he assigned a particular one to each of them. The Liver, for Instance, assists the Concoction of the Aliment in the Stomach and Intestines, by the Heat which it communicates to these Parts: The Spleen is not of so great Use; it is only, in our Philosopher's Opinion, accidentally necessary to collect, prepare, and give a different Direction to the humid Vapours which rise from the Belly: And hence those Animals, in which these Vapours take a different Course, have only very small Spleens. Of this Class are Fowls and Fishes, whose Feathers and Scales are nourished by this Humidity; “and for this very Reason, says he, these Animals have neither Kidney nor Bladder.” The Kidneys also are, according to him, only designed for a Piece of Convenience; since their Office is, to imbibe a Part of the Excrement which is carried to the Bladders of those Animals in which it abounds too much, that the Bladder may be eased of Part of its Burden. He adds, a little after, that the Humours filtrate themselves, or flow through the Substance of the Kidneys; in which, indeed, he has come somewhat nearer to the Use generally ascribed to these Parts: But he talks, at the same Time, very obscurely on the Point.

The Testicles are also, according to him, Parts formed by Nature for Convenience; but are not absolutely necessary. He also affirmed, that two Veins came from the Aorta, and were inserted into the Testicles; and that two other Veins came to  
them

## xxviii An Historical Compendium.

them from the Kidneys; and that these latter Veins contained Blood, but the former none: That there came from the Head of each Testicle, or at least from some one of its Extremities, another larger and more nervous Canal, which bending itself, and lessening by Degrees, ascends to the two others; and, being wrapped up in a Membrane, terminates at the Root of the Penis. He adds, that this last Canal contains no Blood, but a white Liquor; and that, terminating at the Penis, or towards the Neck of the Bladder, it there finds an Aperture which leads to the Penis; about which Opening, there is a kind of Husk, or Bark.

Taking this for granted, he maintained, that, when the Testicles were cut from any Animal, all the abovementioned Canals shrivelled up; and that it was for this Reason, that castrated Animals could not, for the future, propagate their Species. For a Proof of this, he produces an Instance of a Cow, which conceived after Copulation with a Bull immediately after his Castration, and before the feminal Vessels were shrivelled up.

In another Passage he explains himself still more particularly, with Regard to the Use of the Testicles, when he maintains, that they are no Part of the Canals or Reservoirs of the Seed; and that they have nothing in common with them; but that they only serve as a Counterpoise to draw them downwards, and to retard the Motion of the Seed, almost in the same Manner with those Stones which Weavers tie to their Webs. He advanced farther, as a Proof of the Uselessness of the Testicles, with Regard to Generation, the Instances of Fishes and Serpents; which being, to all Appearance, deprived of these Parts, did, nevertheless, propagate their Species.

He also thought that Conception was occasioned by a Mixture of the male Seed with the menstrual Blood

Blood in the Matrix ; and ascribed no other Part in Generation to the female Seed, which, according to him, was only the Excrement of the Matrix, which some Females discharged, and some not ; and that these last were not, on that Account, less fit for Generation, or more deprived of the Sensation of venereal Enjoyments, since it proceeded from the Afflux of Spirits to the Parts of Generation.

As to the Place where the Concoction of the Aliments was performed, and the Manner in which it was brought about, he imagined, that the Aliments were first prepared in the Mouths of such Animals as used any kind of Food which stood in Need of Mastication. But we must not imagine, that, in that Place, any Sort of Concoction is made ; the Food is only reduced into small Parts, that it may the more easily be prepared and penetrated, after it has descended into the Stomach, which are both designed for the Preparation of the Aliments : And as the Mouth is the Opening at which the unprepared Aliments enter, and the Oesophagus the Duct by which it is conveyed to the Stomach ; there must, in like manner, be other Openings, by means of which all the Parts of the Body receive the Degrees of Nourishment which they stand in Need of. These last Openings are the mesenteric Veins which draw what is necessary for them from the Stomach and Intestines, in the same Manner as Horses draw Hay from a Rack.

ARISTOTLE imagined also, that as Plants received their Nourishment from their Roots, which were spread in the Earth ; so Animals received theirs by the mesenteric Veins, which may be compared to so many Roots designed for drawing the Juice from the Stomach and Intestines ; these last Parts being, with regard to Animals, what the Earth is in respect of Plants.

### xxx An Historical Compendium.

I must also observe, with regard to the Anatomy of ARISTOTLE, that he himself never dissected any Thing but Beasts; and that, in his Days, they had not ventured on the Dissection of human Subjects. This he himself seems to insinuate, when he says, that the internal Parts of Man's Body are unknown, or that we have nothing certain relating to them; but that we must judge of them by the Resemblance they bear to those of other Animals which correspond to them.

By these Sketches of the Anatomy of ARISTOTLE, we may form a Judgment of his Knowledge in this Science; and conclude, that he knew very little, or nothing, of the true Uses of the Parts. It must, however, be remarked, that he mentions the Intestinum Jejunum; and distinguishes the Colon, Cæcum, and Rectum; whereas HIPPOCRATES only takes Notice of the Colon and Rectum\*.

DIOCLES CARYSTIUS is said to have lived some little Time after ARISTOTLE, that is, under the Reign of ANTIGONUS. GALEN informs us, that he was the first who wrote upon the Method of dissecting Bodies; this Art, before his Days, being confined to private Families, and only taught to the Children and Pupils of those who possessed the Secret. But the same Author tells us, that DIOCLES made no great Advances in Anatomy.

But much greater Progresses were made, in this Science, by HEROPHILUS and ERASISTRATUS. The former is said to have lived during the Reign of PTOLEMY SOTER, and to have been born at Carthage.

---

\* LE CLERC gives some more Particulars relating to the Anatomy of ARISTOTLE, which may be consulted by the Curious; but it will give no great Information to Anatomists of our Days.



They are reported to have had this in common, that both of them dissected living Subjects. Of the former TERTULLIAN talks in this Manner: “HEROPHILUS, that Physician, or rather Butcher, “who dissected six hundred Men, in order to find “out Nature; who hated Man, in order to know “the Construction of his Body; could not, by “that means, come to a more perfect Knowledge “of his internal Parts, since Death induces a great “Change on all the Parts, as they are not the “same after Death as they were before; especially “since they did not die a natural Death, but under “all the Agonies to which the Curiosity of the “Anatomist was pleased to subject them.”

The Fact may possibly be true; the Possibility of it is not to be disputed, since, in these Days, we meet with Instances of the like Inhumanity. But may we not suspect, that, since these two Persons were the first who dissected human Bodies, the Novelty of the Attempt forcibly struck the Minds of the Vulgar, and laid a Foundation for groundless Exaggerations, and a Publication of more than was real Truth? a Thing very common, upon Occasions of the like Nature.

Witness the Story of MEDEA, who was branded with the Inhumanity of boiling Men alive, for no other Reason, but because she invented warm Baths. And who, to this Day, can persuade the Vulgar, but the Pupils of anatomical Schools secretly convey People in order to dissect them?

It is, however, certain, that HEROPHILUS and ERASISTRATUS had really dissected many human Bodies. The last of these speaks, in a Fragment of his anatomical Works, of the Brain of a Man whom he had dissected; and GALEN \* talks of the

---

\* De Dissect. Vulvæ, Cap. v.

## xxxii An Historical Compendium.

first of these two Men in this Manner : “ He was, “ says he, an accomplished Man, in all the Branches “ of Physic ; but he was particularly knowing in “ Anatomy ; which he had learned, not by the “ Dissection of Beasts alone, as Physicians usually “ do, but, principally, by that of Men.”

GALEN also observes\*, that it was at Alexandria, the Capital of Egypt, where HEROPHILUS made his Dissections ; which makes it probable, that it was owing to the Curiosity of the Kings, and their Inclination to encourage the Arts, that these two Physicians had the Liberty granted them of instructing themselves by dissecting human Bodies ; a Liberty which those of succeeding Times very rarely enjoyed for many Ages, whether thro’ a Defect of Kings of equal Courage and Learning with the first PTOLEMIES, or thro’ the scrupulous Disposition of the People passing to the Sovereigns, or getting the better of their Authority. I am not ignorant that RIOLANUS has maintained, in Opposition to this, that they not only dissected Men before his Time, but that this Practice was even continued down to the Days of GALEN. He also maintained, that ARISTOTLE practised the same kind of Dissection ; but this learned Anatomist proves no more than that ARISTOTLE really dissected Animals, and composed some Books of Anatomy, to which he often refers his Readers. This cannot be denied ; but that he dissected Men, cannot be proved ; since we find ARISTOTLE himself confessing, that he never dissected any Thing but Beasts.

This Anatomist succeeds no better, when he attempts to prove that HIPPOCRATES had dissected human Bodies ; but his Arguments for this will,

---

\* Administrat. Anatomic. Lib. vii. Cap. 5.

upon an impartial Review, be found so weak and inconclusive, that we may safely infer, that HEROPHILUS and ERASISTRATUS were the first who were known to dissect human Bodies. As for the former of them, one of the principal Proofs of his Accuracy is this; that he addicted himself to those Parts of Anatomy which had not before been touched upon.

NEUROLOGY, or the Dissection of the Nerves, was, in his Days, a Part of Anatomy, not, as yet, well known. GALEN informs us, that HEROPHILUS was the first, after HIPPOCRATES, who handled this Matter with Accuracy; but he shares the Praise, due to him in this Respect, with another Physician, EUDEMUS.

As for HIPPOCRATES, who likewise comes into the Account upon this Occasion, GALEN, being resolved to extol him above all the antient Physicians, honours him with a Degree of Knowledge, in this Respect, which his Writings nowhere discover.

It is very probable, that HEROPHILUS was the first who was known to discover the Nerves, properly so called, and who knew how to demonstrate them. According to RUFUS EPHESIUS, he divided the Nerves into three Kinds. The first he called *Ἀισθητικὰ καὶ προαισθητικὰ νῆυρα*, or those Nerves which are the immediate Instruments of Sensation, and the Ministers of the Will: These, according to him, derived their Origin from the Brain, from which they rose like so many Branches, and were a Part of the Medulla Spinalis. The second proceeded from some of the Bones, and terminated at others of them. The third arose from some of the Muscles, and terminated at others. By this we see, that HEROPHILUS gave the Name of Nerves to those Parts, which were afterwards called Liga-

## xxxiv An Historical Compendium.

ments and Tendons. But it is a Matter of little Moment what Names Things receive, provided they be sufficiently distinguished.

In reality, this Distinction of three Sorts of Nerves, ascribed to this antient Anatomist, is a Proof that no such Distinction was made before his Time, and that these Parts were confounded with one another.

The Writings of HEROPHILUS being lost, we know no more of his Sentiments, with regard to the true Nerves, but that he gave the Name of Optic Pores to those Nerves which reach to the Bottom of the Eye, and which now are called Optic Nerves; and maintained, that they had a sensible Cavity, which was not to be met with in other Nerves.

There is nothing remarkable, with respect to his Notions of the Uses of the Brain, except that we are told, that he imagined the reasonable Soul was lodged in its Ventricles.

But one of his principal Discoveries, which tho' looked upon to be the Product of our own Age, is nevertheless very antient; is, his finding certain Veins in the Mesentery, which, according to him, were destined to nourish the Intestines, which do not, like the other Veins, go to the Venæ Portæ, but terminate in certain glandular Bodies. ERASISTRATUS likewise discovered something of this Nature, which now are called the lacteal Veins.

Besides, as HEROPHILUS had learned Anatomy, not by reading the Books of his Predecessors only, and formed particular Ideas of the Parts from what he had seen in Dissections, especially those of human Bodies; he expressed these Ideas by Words which appeared to him most proper for that Purpose; that is, he invented new Names, and gave Names to Parts which before had none.

For instance ; he called the first of the Intestines, or that which is next to the Stomach, Δωδεκαδάκτυλον, because it is twelve Inches in Length\*.

Having also observed, that the Vessel which passes from the right Ventricle of the Heart to the Lungs, and which he took for a Vein, had a thick Coat like that of an Artery ; he called it, if we may believe RUFUS EPHESIUS, the arterial Vein ; and, for a quite contrary Reason, he called the Vessel which comes from the Lungs to the left Ventricle of the Heart, the venous Artery. But though the Names he gave to those Vessels point out the Knowledge he had of the Heart, and the Vessels with which it is immediately connected, yet GALEN observes†, that he has been very negligent in describing the Membranes of the Heart, to which he had, nevertheless, given a Name ; calling them nervous Separations, or Partitions.

It was also HEROPHILUS who first called two Tunics of the Eye the Tunica Retina, and the Tunica Arachnoïdes : He also called that Membrane which lines the Ventricles of the Brain, the Membrana Choroides, because he saw that it resembled the Chorion which covers the Fœtus in the Matrix.

He also compared the Cavity which forms the fourth Ventricle of the Brain, 'Αναγλυφή τῆ καλάμου, to the Concavity of a writing Pen, or Reed, used for that Purpose in Egypt. He has, in like manner, given the Name of Ἀνθή, Torcular, to that Place where all the Sinuses of the Dura Mater unite.

\* The Moderns need not cavil, as the Antients used to measure Inches by the Extremities of their Fingers.

† De HIPPOCRAT. & PLATON. Decret. Lib. I. Cap. 10.

## xxxvi An Historical Compendium.

It was he likewise who gave the Name of Glandulæ Paraſtataæ to thoſe Glands which lie about the Root of the Penis.

He ſtilled theſe Paraſtataæ glandulous, in order to diſtinguiſh them from other Paraſtataæ, which he called varicoſe, and which he placed at the Extremity of thoſe Veſſels which convey the Seed from the Teſticles; or rather, as he thought, which ſerve to prepare it. For though he did not deny that the Teſticles ſerved, in ſome meaſure, to the Generation of Seed; yet he thought, that the abovementioned Veſſels contributed much to that Purpoſe.

The Word Paraſtata imports any Thing ſituated near another. Some antient Phyſicians have alſo given the ſame Name to the Epididymis.

It is plain, that HIPPOCRATES and ARISTOTLE knew the varicoſe Paraſtataæ of HEROPHILUS, though they did not give them the ſame Name.

The Authority of HEROPHILUS, in Point of Anatomy, was ſo great, that almoſt all the Names he aſſigned to the different Parts are ſtill preſerved. The Teſtimony of Antiquity is ſo ſtrong, in Favour of him, that we cannot, without injuring his Character, deny him to have been the beſt Anatomist of his Time. If his Writings had reached our Hands, we might have been able to have judged of his Sentiments for ourſelves; but as they are loſt, we can ſay no more, than that what is preſerved in Quotations is ſufficient to give us a great Idea of his Exactneſs and Skill, eſpecially if we conſider that he lived at a Time when Anatomy was only in its Infancy, and that his whole Stock of Knowledge, in this Particular, was principally of his own acquiring.

FALLOPIUS, a knowing Anatomist of the laſt Age, was ſo ſuperſtitious an Admirer of HEROPHILUS,

PHILUS, that he laid it down as a Maxim, that it was as unreasonable to contradict him, in Point of Anatomy, as to contradict the Gospel: But the Encomium was too extravagant.

It is generally thought, that ERASISTRATUS was contemporary with HEROPHILUS, or lived very soon after him.

It was by means of Anatomy that this Physician first became considerable in the World; and GALEN, who, upon many Occasions, talks unfavourably of him, yet confesses, that ERASISTRATUS had contributed a great deal to the Re-establishment of Anatomy, which, as he says, had been, in a great measure, lost for some Time before: But it is no easy Matter to find out what particular Period of Time he has in View. However, that we may understand the Passage the better, it is necessary to relate the Whole of it. “Those, says he, who are not ashamed to speak “against Evidence, are the Cause of the Length “of this Dispute” (the Dispute betwixt him and CHRYSIPPUS the Stoic, who maintained, that the Seat of the Soul, and the Origin of the Nerves, was in the Heart). We ought not to accuse either HIPPOCRATES, EUDEMUS, HEROPHILUS, or MARINUS, who, since the Days of the Antients, have re-established the Science of Anatomy, which had been neglected, ἐν τῷ μετὰ χρόνῳ, in the intermediate Space of Time between them.

GALEN, at first, seems to hint at the Time which passed between ESCULAPIUS, or his first Descendants, and HIPPOCRATES; which is that dark Period, during which the State of Physic was not known: But we shall see, by what he says elsewhere, that he meant no such Thing. In order, then, to prevent the Contradiction between the Passage now quoted and some others of the same Author, we must necessarily put a Point after

### xxxviii An Historical Compendium.

the Word HIPPOCRATES, and begin another Period, thus: " We ought not to lay the Blame  
" upon HIPPOCRATES, neither ought we to ac-  
" cuse ERASISTRATUS, EUDEMUS, HEROPHI-  
" LUS, nor MARINUS; who, after the Antients  
" have re-established the Science of Anatomy,  
" which had been neglected in the Time inter-  
" vening between them." Or this Sentence of  
GALEN may be translated thus: " We ought nei-  
" ther to accuse HIPPOCRATES, nor those who  
" have re-established Anatomy, which had been  
" neglected in the Interval between them and him,  
" such as ERASISTRATUS, EUDEMUS, HERO-  
" PHILUS, &c." According to this Explication,  
which is the genuine Sense of GALEN, HIPPO-  
CRATES will not be ranked among the Restorers  
of Anatomy, which would not agree with what  
the same Author says in another Passage\*: " That  
" the antient Physicians, and even the antient Phi-  
" losophers, were very much addicted to the Study  
" of Anatomy; and that, in those Days, Fathers  
" not only trained up their Children in it, by ob-  
" liging them to read and write upon the Subject,  
" but also, by making them dissect Subjects them-  
" selves: So that, having learned the Thing from  
" their Infancy, it was impossible they should for-  
" get it. But, continues he, it was not so after-  
" wards, when Physic came to be out of the  
" Hands of the ASCLYPIADEAN Family, and when  
" Physicians began to teach their Art to Strangers,  
" especially to Men advanced in Years, for whom  
" they had an Esteem, and whom they revered  
" on account of their Virtue. These Men, not  
" being young enough to labour at Anatomy with  
" Success themselves, or to inform themselves of

---

\* De Administr. Anatom. Lib. II. Cap. 1.



“ the Parts of the Body by their own Sight, and  
 “ by putting their Hands to the Work, could  
 “ only learn Anatomy very imperfectly. Hence  
 “ it was, that, in Proceſs of Time, the neceſſary  
 “ Inſtructions, in this Branch of Learning, paſſing  
 “ often from one Hand to another, Anatomy grew  
 “ ſtill worſe and worſe.”

Thus GALEN ſuppoſes that Anatomy was in a flouriſhing State whilſt Phyſic was confined to the ASCLYPIADEAN Family; he even fixes, in expreſs Terms, the Beginning of its Declenſion, at the particular Time when Phyſic began to be practiſed by others, than thoſe of that Family.

Now we are no-where informed that Phyſic was practiſed out of this Family till the Philoſophers began to encroach upon the Art, or, at leaſt, till HIPPOCRATES began to teach Diſciples, as GALEN elſewhere obſerves. As this is the Caſe, it is ſcarce to be believed that the Philoſophers were the Cauſe of the Decay of Anatomy, ſince it was their Intereſt to carry it to its Perfection, even tho’ they had not had the Intereſt of Phyſic in View.

GALEN himſelf does not think that this was the Caſe; ſince he joins the Philoſophers and Phyſicians together, when he ſpeaks of the Time wherein Anatomy was in its Perfection; and by the Philoſophers, he undoubtedly meant DEMOCRITUS, and others who preceded HIPPOCRATES. So that the Time ſpoke of muſt be that which followed the Death of HIPPOCRATES.

But there is a conſiderable Difficulty in this Point: For if HIPPOCRATES was ſo ſkilful an Anatomist as GALEN repreſents him, who can poſſibly believe that his Knowledge, in this Particular, ſhould have been ſo ſoon loſt, or raſed from the Memories of Men, that DIOCLES, PRAXAGORAS, and the other Phyſicians of their Time,

## xl An Historical Compendium.

were so little improved by his Discoveries, or the Traditions of them, that GALEN has\*, with Justice, stiled them unskilful Anatomists? Before this could happen, a considerable Time must have intervened between HIPPOCRATES and these Physicians; but where shall we find all these Successions, or that great Number of Generations, since all the Authors agree, that DIOCLES followed not long after HIPPOCRATES; so that he must have been contemporary with PLATO? As this is the Case, if he did not see HIPPOCRATES himself, he must, at least, have seen his Sons, or his Sons-in-law, who may reasonably be presumed to inherit the Knowledge of their Father, in Point of Anatomy, as well as of the other Branches of Physic. And as for PRAXAGORAS, who lived almost in the same Time with DIOCLES, tho' he had not had an Opportunity of instructing himself in the same Way, that is, by the Traditions of HIPPOCRATES and his Disciples; yet, according to GALEN himself, he was one of the Descendants of ESCULAPIUS, the Children of whose Family were trained up to Anatomy from their Infancy: So that, in this Respect, HIPPOCRATES could enjoy no greater Advantages than he. GALEN would not have involved himself in this Difficulty, if he had not been unreasonably prepossessed in Favour of the ASCLYPIADEAN Family, as may be easily seen by his Works.

It is certain, that before ERASISTRATUS and HEROPHILUS, carried Anatomy to a higher Pitch of Perfection; but GALEN, who looked upon the former of these as the Rival of HIPPOCRATES, was unwilling to confess this; but declares, all along, in Favour of the latter.

---

\* De Diffect. Vulvæ, Cap. 9.

It is also certain, that, before ERASISTRATUS and HEROPHILUS, Anatomists had never ventured to dissect human Bodies; and that, in the Time of ARISTOTLE, who lived not long before these two Physicians, they had only dissected Beasts.

It must be owned, that, in Egypt, they had, long before, a Custom of embalming their dead Bodies, which could not be done without opening them; and GALEN himself confesses, that this Custom might have furnished the Physicians of that Country with a favourable Opportunity of instructing themselves: But as it is not probable that those Persons, who were employed in embalming, durst satisfy their Curiosity entirely, and search as narrowly as was necessary into the human Body, which was looked upon as something sacred; Anatomy could not possibly arrive at any considerable Pitch of Perfection, whilst no other Means were employed in its Cultivation: Carcasses, upon which every Thing might be attempted, were absolutely necessary for that Purpose. These were, probably, first granted in Consequence of the Inclination which the Kings of these Times had to advance the Arts and Sciences.

ALEXANDER THE GREAT first began to patronize those who applied themselves to natural History, by ordering ARISTOTLE to labour at that of Animals, and their several Parts; and, without doubt, PTOLEMY SOTER, or PTOLEMY the Son of LAGUS, succeeded ALEXANDER, as well with regard to this Inclination, as to that Part of his Empire which fell to his Share. This appears still the more probable, if we consider, that PTOLEMY was a Man of Learning, and wrote, himself, a History of ALEXANDER, as we learn from ARRIAN. PTOLEMY PHILADELPHUS, Son of the preceding PTOLEMY, was no less industrious in promoting Arts and Sciences; since he invited to his

## xlii An Historical Compendium.

his Capital all the learned Men of his Time ; and collected, at an extraordinary Expence, a Library of Books from all Parts of the World, in order to form a Library ; which was still augmented by his Successors.

It is probable, that these two Kings, getting over the Scruple which had till then reigned, of dissecting human Bodies, not only granted the Physicians the Bodies of Criminals after their Death ; but, if we may give Credit to some Authors, put into their Hands many of these wretched Creatures to be dissected ; imagining that they might, by that means, discover Things which otherwise they could not do. “ HEROPHILUS “ and ERASISTRATUS, says CELSUS, have dissected living Criminals, condemned to Death, “ and dragged from their Prisons, by the Order of “ their Kings, for that very Purpose.”

Which soever of these two Princes ERASISTRATUS lived under, it is probable, that he laid hold of this favourable Opportunity, and made those Discoveries in Anatomy which gained him so high a Reputation. But as his Writings have not reached us, we know no more of his Sentiments than what are transmitted to us by GALEN, who generally quotes him with no other View but to refute him.

The principal of ERASISTRATUS's Discoveries, which, by the way, was not made upon human Bodies, but which, at the same Time, acquired him abundance of Honour, was, his finding out \* certain white Vessels in the Mesentery of sucking Kids, which he believed to be Arteries. He added, that these Vessels seemed at first to be full of Air, and afterwards Chyle.

---

\* GALEN. an Sanguis sit Natura in Arteriis, Cap. 5. & Administrat. Anatom. Lib. VII. Cap. ult.

## An Historical Compendium, xliii

ERASISTRATUS and HEROPHILUS were the first who knew the true and genuine Use of the Brain and Nerves, or, at least, the Uses ascribed to them by all succeeding Anatomists. RUFUS EPHESIUS says, that ERASISTRATUS owned two Sorts of Nerves; those which are the Instruments of Sensation, and those that are the Instruments of Motion. He maintained, according to GALEN, that the former were hollow, and drew their Origin from the Membranes of the Brain; whereas the other sprung from the Brain itself, and the Cerebellum. But GALEN informs us\*, that ERASISTRATUS having enquired more accurately into the Matter, was at last convinced, that all the Nerves proceed equally from the Brain. This may be gathered from a Passage of this antient Anatomist, related by GALEN, the whole of which I shall translate, that we may see what Notions he entertained with respect to the Brain, Cerebellum, Nerves, and all the several Parts connected with each of them.

“ We examined, says ERASISTRATUS, what  
“ the Nature of the human Brain was; and we  
“ found it divided into two Parts, as it is in all  
“ other Animals. It had a Ventricle, or Cavity,  
“ of a longitudinal Form (here there seems to be  
“ a Chasm, or Defect, in the Text): These Ven-  
“ tricles had a Communication with one another,  
“ and terminated in a common Opening, accord-  
“ ing to the Contiguity of their Parts, reaching  
“ afterwards to the Cerebellum, where there was  
“ also a small Cavity; but each Part was sepa-  
“ rated from the other, and shut up in its proper  
“ Membranes; and the Cerebellum, in particular,  
“ was wrapped up by itself, as well as the Brain,

---

\* De HIPPOCRAT. PLATON. Decret. Lib. vii. Cap. 3.

“ which,

## xliv An Historical Compendium.

“ which, by its various Windings and Turnings,  
“ resembled the Intestinum Jejunum. The Cere-  
“ bellum was, in like manner, folded and twisted  
“ different Ways, so that it was easy to know, by  
“ seeing it, that, as in the Legs of swift running  
“ Animals, such as the Hart, Hare, and some  
“ others, we observe Tendons and Muscles well  
“ calculated for that Purpose; so in Man, who  
“ has a larger Share of Understanding than other  
“ Animals, this great Variety and Multiplicity of  
“ Foldings in the human Brain was, undoubtedly,  
“ designed for some particular End. Besides, we  
“ observed, continues ERASISTRATUS, all the  
“ Apophyses or Productions of the Nerves which  
“ come from the Brain: So that, to say all at  
“ once, the Brain is visibly the Principle of every  
“ Thing that passes in the Body; for the Sense of  
“ Smelling proceeds from the Nostrils, being  
“ pierced, in order to have a Communication with  
“ the Nerves. The Sense of Hearing is also  
“ produced by the like Communication of the  
“ Nerves with the Ears. The Tongue and the  
“ Eyes receive also the Productions of the Nerves  
“ of the Brain.”

Here we see, by the Confession of ERASISTRATUS himself, that he had dissected Men. He had also very accurately described, in GALEN'S Opinion\*, the Membranes which are found at the Orifices of the Heart; and he maintained, with ARISTOTLE, that the Veins and Arteries drew their Origin from it. “ There are, says he, certain  
“ Membranes inserted in the Orifices of the Vessels of the Heart, of which the Heart makes  
“ Use, either for the Reception or Expulsion of  
“ such Substances as either enter into it, or come

---

\* De HIPPOCRAT. & PLATON. Decret. Lib. I. Cap. 10. & Lib. VI. Cap. 6.

“ out of it. Some, adds GALEN, have been so  
 “ rash as to deny that there were such Mem-  
 “ branes, and have looked upon them as Fictions  
 “ of ERASISTRATUS, or a kind of Hypothesis in-  
 “ vented to support his own System: But these  
 “ Membranes are so well known by Anatomists,  
 “ that none but Novices in the Art are ignorant  
 “ of them. There are, continues GALEN, three  
 “ of these Membranes at the Orifice of the Vena  
 “ Cava, which resemble the Points of Arrows;  
 “ whence some of the Disciples of ERASISTRATUS  
 “ have called them *Τριγλῶχινες*, Tricuspides. There  
 “ are also, at the Orifice of the Arteria Venosa (for  
 “ so I call the Artery which, rising from the left  
 “ Ventricle, disperses itself in the Lungs), Mem-  
 “ branes of a like Form, but of different Names;  
 “ for that Orifice has only two Membranes. The  
 “ other two Orifices, I mean that of the Vena Ar-  
 “ teriosa, and that of the Arteria Magna, have  
 “ also each of them three Membranes, resembling  
 “ the Sigma of the Greeks, which resembled our  
 “ C.”

Here GALEN, ceasing himself to speak, again  
 introduces ERASISTRATUS; saying, that “ These  
 “ two last Orifices are equally disposed to convey  
 “ any Thing from the Heart; that through the  
 “ former the Blood flows to the Lungs, and thro’  
 “ the latter the Spirits, in order to be distributed  
 “ thro’ the whole Body.” (Here some Part of  
 the Greek Text seems to be wanting.) “ Thus  
 “ it happens, continues ERASISTRATUS, that these  
 “ Membranes alternately perform opposite Offices  
 “ to the Heart. Those which are adherent to the  
 “ Vessels by which Substances are carried into the  
 “ Heart, bend inwards, that they may yield to the  
 “ Impetuosity of such Things as are carried to-  
 “ wards them, and, lying in the very Cavities of  
 “ the Heart, may open its Entry for the Intro-  
 “ duction,

## xlvi An Historical Compendium.

“duction of such Substances as are attracted to it:  
“For we have no Reason to imagine that such  
“Substances enter the Heart of their own Accord,  
“as if it were an inanimate Receptacle; but the  
“Heart, by its Diastole or Dilatation, draws them  
“to it, as the Blacksmith’s Bellows does the Air;  
“and in this Manner the Heart is filled. The  
“Membranes of those Vessels, on the other Hand,  
“which serve to convey Things from the Heart,  
“are quite differently disposed and situated; so  
“that, yielding easily to the Substances coming  
“from the Heart, they open their Orifices, at the  
“Time it thrusts out such Substances; whereas,  
“at other Times, they shut up these Orifices, and  
“allow nothing to return which is once thrust out;  
“just as the Membranes of the Vessels, which  
“serve to introduce Things into the Heart, shut  
“the Orifices of these Vessels, upon the Heart’s  
“contracting itself, and allow nothing to be car-  
“ried out, which is once thrown in.”

It were to be wished, that GALEN had left us more Fragments of ERASISTRATUS, of the same Nature with these two.

Besides, what he elsewhere says, that some thought the Membranes of the Heart a Fiction of ERASISTRATUS, is a sure Proof that the Book *De Corde*, ascribed to HIPPOCRATES, was not really wrote by him; since in it these Membranes are made mention of. If this Book had been wrote by the Author whose Name it bears, GALEN would not have failed to take Notice of it, for his Honour, and in order to stop the Mouths of those who thought that these Membranes were an Invention of ERASISTRATUS. He had nothing to do but to let these People see, that HIPPOCRATES had wrote before on the same Subject.

But it is surprising that this same ERASISTRATUS, who had so accurately examined the Heart,



and dissected so many living Animals, should yet embrace an Opinion, with regard to the Arteries, which all other Anatomists have looked upon as absurd. He affirmed, as did PRAXAGORAS before him\*, that, in a natural State, the Arteries contained no Blood; and that they, as well as the left Ventricle of the Heart, were only filled with Air. It was an easy Matter to give him the Testimony of his own Eyes for his Error; but he had Recourse to this Subterfuge†. “As soon, said he, as we open the left Ventricle of the Heart, that Air or Spirit is evaporated before we can observe it, and the Ventricle is instantly filled with Blood.” He asserted the same Thing with regard to the Arteries.

What engaged him to entertain this Opinion, with regard to the Arteries, was, as GALEN informs us, because he could not conceive how there should be two Kinds of Vessels destined for the Conveyance of the same Liquor; that is, why both the Veins and Arteries should contain and convey the Blood. If he had known the Secret of the Blood's Circulation, which some learned Men imagine is plainly found in the Writings of HIPPOCRATES, he had not been so much puzzled and perplexed with regard to this Point: He might even have informed himself of it by the Knowledge he had of the Membranes or Valves of the Heart, if he had not been mistaken with regard to one of them. What follows will illustrate this Anatomist's Opinion, and, at the same Time, inform us, what his Sentiments were, with regard to the Causes of Diseases.

---

\* GALEN. an Sanguis sit Natura in Arteriis.

† Ibid. & PLATON. Decret. Lib. I. Cap. 6. & De Venesect. adv. ERASISTRAT. Cap. 3.

## xlviiii An Historical Compendium.

GALEN says\*, that ERASISTRATUS maintained,  
“ That the great Vein was the Reservoir of the  
“ Blood, and the great Artery that of the Spi-  
“ rits.” He added, “ That, after these Refer-  
“ voirs had divided themselves into many Branches,  
“ they became smaller, and their Number greater ;  
“ and that as there is no Place in all the Body,  
“ where any of these Branches terminate, that has  
“ not a smaller Branch which receives what was  
“ brought to it by the larger ; so it happens, that,  
“ before these Vessels arrive at the Surface of the  
“ Body, they divide themselves into Branches so  
“ small and minute, that the Blood they contain  
“ cannot pass thro’ them : So that, adds our Au-  
“ thor, tho’ the Mouths of the Arteries and Veins  
“ be very near each other, yet the Blood keeps  
“ itself within its proper Bounds, without enter-  
“ ing the Vessels in which the Spirits flow ; and,  
“ in this Case, the Animal remains in its natural  
“ State : But when any violent Cause happens to  
“ disturb this Oeconomy, the Blood forces itself  
“ into the Arteries, and proves the Source of  
“ Disorders. Among the Causes now mentioned,  
“ too great a Quantity of Blood is the principal ;  
“ for, in that Case, the Coats of the Veins are di-  
“ lated more than ordinarily, and their Extre-  
“ mities, which were formerly shut up, are opened ;  
“ whence follows a Transfusion of Blood from  
“ the Veins into the Arteries ; and this Blood, by  
“ its Irruption, opposing the Course and Motion  
“ of the Spirits which come from the Heart, if  
“ this Opposition is direct and immediate, or if  
“ the Blood stops in a principal Part, this causes  
“ a Fever ; but if the Spirits should happen to  
“ drive it backwards, so that it does not pass the

---

\* De Venesect. advers. ERASISTRAT.

“ Extremity of the Artery, in that Case, an In-  
 “ flammation of the Part is only produced. As to  
 “ the Inflammation and Fever which happen in  
 “ Wounds, they are also occasioned by the sudden  
 “ Evacuation of Spirits, which is the Consequence  
 “ of the Cutting of the Artery, and forces the  
 “ Blood continually into the Place of the Spirits,  
 “ least there should be a Vacuum.”

ERASISTRATUS made use of this Comparifon to fupport his Syftem\*. As the Sea, fays he, which remains in a Calm, when ſhe is not ruffled by Winds, ſwells in an extraordinary Manner, and overflows her Shores, when the Wind blows hard; ſo the Blood moving in the Body, departs from its ordinary Canals, and enters into the Reſervoirs of the Spirits, where it afterwards becomes warm, and puts all the Body, as it were, on a Fire.

Theſe are the Notions which ERASISTRATUS entertained with regard to the Cauſes of Diſeaſes in general, which at the ſame time are very different, from thoſe attributed to him; by the Author of a Treatiſe aſcribed to GALEN, intitled the INTRODUCTION; who affures us, that this Phyſician did not ſearch for the Cauſes of Diſeaſes in the Humours, or the Spirits, but in the ſolid Parts; whereas HIPPOCRATES looked upon theſe three Subſtances, as the Cauſes of Health and Diſeaſes. I think that Author only means that ERASISTRATUS did not admit of the different Humours mentioned by HIPPOCRATES, or at leaſt ſeemed to think them of ſo little Importance, as not to aſcribe the Cauſes of Diſeaſes to them. This is what GALEN himſelf confirms; but he aſſerts at the ſame time, that though ERASISTRATUS over-

\* GALEN. Hiſt. Philoſoph. PLUTARCH. CELS.

# 1 An Historical Compendium.

looked and neglected the Humours, he was nevertheless obliged to speak of them on some Occasions, as for Instance\*, when he says, that a Palsy proceeds from the Humour, which nourishes the Nerves, being stopped on Account of its too great Viscidity, and when he talks of the Bile and black Urine.

With regard to Respiration†, he maintained, that it was only useful to Animals by filling their Arteries with Air, which is a Consequence of his former Hypothesis; and he imagined that the thing was done in this Manner: When the Thorax‡ or Breast dilates itself, the Lungs are also dilated, and filled with Air. This Air passes to the very Extremities of the Aspera Arteria; and from them to those of the smooth Arteries of the Lungs, from which the Heart draws it when it dilates itself, to carry it afterwards through all the Parts of the Body, by means of the great Artery.

When it was objected to him, that the Heart moved in its ordinary Manner, when a Person retains his Breath, he answered, That, upon that Occasion, the Heart drew Air from the great Artery. To this, it was replied, that the Membranes which adhere to the Orifice of this Artery, will not so much as allow it to return from it to the Heart. But he thought to extricate himself by saying, That though this was the Case in a Natural State, yet it did not follow, that it must be so during the Time a Person retains his Breath, which is a State of Violence, and consequently cannot last very long.

ERASISTRATUS also entertained a very singular Opinion, with regard to the Manner in which the Aliments were prepared in the Stomach. He thought, that the Stomach contracts itself, that it may more closely embrace the Food, and break

---

\* De Atra Bile. † GALEN. de usu Respirat. Cap. 1. ‡ GALEN. de usu Respirat. & de Locis affect.

its Texture ; that Trituration corresponding, according to him, to the Concoction of which HIPPOCRATES speaks. And with regard to the Chyle, that is the Juice of the Aliments extracted in the Stomach, he maintained\*, that passing from the Stomach to the Liver, it arrived at a certain Place, where the Branches of the Vena Cava, and the Extremities of the Vessels, which are connected with the Reservoirs of the Bile, equally terminate ; so that the Parts of the Bile insinuate themselves into the Orifices of these two Kinds of Vessels, according as these Orifices are disposed to receive them ; that is, every thing of a bilious Quality in the Chyle, passes into the Canals connected with the Reservoir of the Bile, and the pure Blood passes into the Vena Cava, and taking another Course, is separated from the Bile. GALEN† makes ERASISTRATUS say, that the Veins are divided in the Liver for the Separation of the Bile.

Besides we must observe‡ that neither ERASISTRICATUS, nor his Successors, pretended to account for the Causes of certain Effects ; Researches of which Kind they thought belonged more properly to the Philosophers than to the Physicians. Tho' they believed, for Instance, that the Stomach contracts itself for the embracing the Food the more closely, yet they were not at the Pains to enter into minute Explications of the particular Causes and Manner of this Contraction. Neither did they hesitate to own, that they were uncertain whether the Bile was produced in the Body, or if it was before contained in the Aliment.

Another Proof of the Ingenuity of ERASISTRATUS, we have in AULIUS GELLIUS||, who in-

\* GALEN. de Facult. Natur. Lib. II. Cap. 9. † De usu Pârt. Lib. IV. Cap. 13. ‡ GALEN de Facult. Natur. Lib. II. & de Atra Bile, Cap 5. || Lib. XVI. Cap. 3.

forms us, that he frankly owned, when talking of unfatiable Hunger, or a Boulimia, (a Word not to be found in HIPPOCRATES, but which all the Greek Physicians after him have made use of) that he did not know why the Disease happened rather during great Cold, than in hot Weather; though he imagined, that Hunger, in general, proceeded from the Stomach and Intestines being empty; and that a long and unpainful Abstinence was owing to the Stomach's being strongly contracted and shrivelled up. It was for this Reason, added he, that those who fast voluntarily feel Hunger towards the Beginning of their Course, but not after they have fasted for some Time. He brought in support of his Opinion, the Example of the Scythians \*, who, when they were obliged to fast, swaddled themselves up with large Rowlers, with a View to contract or strengthen their Stomachs.

ERASISTRATUS owned, that the Urine was separated in the Kidneys, but he did not acknowledge, with HIPPOCRATES, that it was done by Attraction; for he entirely rejected this sort of Attraction, though he no where explains himself with regard to the Manner, in which this Separation is made. Some of his first Followers believed, as GALEN informs us, that the Parts above the Kidneys received only pure Blood; that what is aqueous, or charged with Serosities, tends downward by its own Weight; and that after this Blood is separated from the aqueous, an useless Part, it is carried to the Parts above the Reins to nourish them.

It is necessary also to observe, that ERASISTRATUS rectified PLATO with regard to the Use of the Arteria Trachea, through which PLATO imagined

---

\* GALEN. de Natural. Facultat. Lib. i. Cap. ult.

the Drink was carried, in order to water the Lungs\*. This Opinion was common to PLATO, with PHILISTION, HIPPOCRATES, and most of the Physicians of those Days. LYCUS and QUINTUS are also mentioned as two ancient Anatomists, but nothing particular is known of their Discoveries.

MARINUS is also mentioned, as an Author who wrote well on the Anatomy of the Muscles; after the Time of ERASISTRATUS, GALEN is said to have epitomized his Works.

AURELIUS CORNELIUS CELSUS is also an Author of too distinguished Merit to be passed over in Silence. He was born at Rome, and in all Probability, flourished under TIBERIUS, CALIGULA, CLAUDIUS, and NERO. Many things are found dispersed in his Writings, from which we may gather, that he rarely employed himself in Dissections; but that he had, at the same time, a very high Veneration for Anatomy.

Besides his Books De Re Medica, he also wrote concerning the Figure and Situation of all the Bones of the human Body, which, indeed, is the principal Reason why he should not be overlooked, upon an Occasion of this Nature.

His Sentiments, with respect to Anatomy, are specified in the beginning of this Narrative.

CAIUS PLINIUS SECUNDUS was, according to some, born in Novocomum; others will have him to be a Native of Verona; but however this be, it is certain, that he lived under the Emperor VESPATIAN, about the Year 72. His Writings are interspersed with many curious Observations, relating both to the Anatomy of Men, and other Animals; but as he was no professed Anatomist, and never appears to have been exercised in Disec-

\* See AULUS GELLIUS, PLUTARCH, and MACROBIUS.

## liv An Historical Compendium.

tions, he took, and inserted in his Works, Truth and Fiction indiscriminately, as he met with them in the Writings of others.

Dr. WIGAN, as well as all Authors, who have mentioned the incomparable ARETÆUS, have been sensible of the Difficulty of fixing the Time in which he lived, but concludes it probable, that he wrote after the Beginning of NERO's Reign, and before that of DOMITIAN. His Taste may be judged from this, that he thought a Knowledge of Anatomy so necessary, both for discovering the true Causes of Diseases, and the proper Methods of Cure, that in the Beginning of almost every Chapter he premises something concerning the Structure of the Part affected. In this Instance he seems to have pursued the Steps of ERASISTRATUS and HEROPHILUS, who were the Chiefs of the dogmatic Sect, and maintained, that without a Knowledge of Anatomy, no one could possibly be a skilful Physician. So that ARETÆUS, though a concise and compendious Writer, has yet insisted upon this Branch of Medicine more copiously, and with more Accuracy than any of the antient Physicians.

The Heart is, according to him, the Principle of Life and Strength, in which the Soul and Nature of Man, reside in a particular Manner. This was also the Doctrine of HIPPOCRATES and CHRYSIPPUS the Stoic. For this Reason, a Syncope, as it is a Disease of the Heart, and consequently must have an immediate Influence upon Life, is unfriendly to the human Constitution, and in some Measure dissolves and destroys that Connection, by which the vital Faculty is maintained. He also asserted, that the Heart was a warm Part of the Body, and the Principle of Life and Respiration; that it is situated in the Middle of the Lungs; and that the Heart inspires the Lungs with a Desire of fresh Air, as it heated the Lungs, but that the Heart itself attracts it.



## An Historical Compendium.   lv

The Lungs were, according to him, naturally incapable of Pain, because they consisted of a loose Sort of Substance resembling Wool. He also maintained, that rough cartilaginous Arteries, incapable of Pain, were distributed through them, and that they had no Muscles, but only some small and slender Nerves, by means of which their Motion was produced. And this, according to him, was the true Reason why in a Peripneumony, which is no more than an Inflammation of the Lungs, the Lungs themselves are insensible of Pain ; and only a sort of Heaviness at the Breast, which is nevertheless free from Pain, afflicts the Patient ; but that all those Membranes, by which the Lungs are connected to the Breast, are endowed with a most exquisite Sensation ; and if they are inflamed, together with the Lungs, the Patient is pained as in the Case of a Pleurisy accompanied with a Peripneumony.

This, according to him, is also the Reason why in Spitting of Blood, where the Blood, being immediately discharged from the Lungs, creates the most dangerous of all Disorders, the Patients never cease to hope, even in the very last Stages of the Disorder, because the Lungs themselves are insensible of Pain ; for under every trifling Degree of Pain, the Patients become afraid of Death, and most People are more frightened for the Consequences, than hurt by the Disease itself ; whereas in the most terrible Disorders, when unaccompanied with Pain, the Patient is not racked with the Fears of Death ; and indeed this Distemper is more fatal than frightful to the Patient.

The Pulsation of the Arteries, according to him, propelled the Blood ; for which Reason, if the Arteries are wounded, the Lips of the Wound are with Difficulty brought together, and kept in Contract. The Arteria Crassa, or the Aorta, which

runs near the Vena Cava, in the same Direction with the Spina Dorsi, and by ARETÆUS, after PRAXAGORAS, called Ἀρτερία πυχτή, suffers Inflammation along with the Vena Cava, which Inflammation was by the Ancients called a Species of Causus, since in both, the same Symptoms appear, and the Fever in the one Case tends to a Syncope, as well as in the other; for the Liver, is the Root of the Veins, and the Heart, the Source and Origin of the Arteries. It is therefore probable, that the superior Parts of these Viscera are affected; for the Heart imparts Warmth to the Arteries, and the Liver conveys Blood to the Veins. Now since both these Viscera are very large, the Inflammations to which they are subject, must of Course be very considerable. But this same Artery, in Inflammations of the Vena Cava, palpitates near the Spina Dorsi, which appears from the Pulsation in the other Part of the Præcordia; for the Artery, lying close by the Vein on its left Side, is drawn into Consent with it, as being dispersed through the whole Body.

Those of the Ancients, whose Writings have been handed down to us, scarce make any mention of the Disorder of this Artery and Vein. But whoever has handled this Subject, has followed the Opinion of PRAXAGORAS, who, as we learn from RUFUS EPHESIUS, affirmed that the Origin of Fevers was in that Vein, which sends Branches from the Liver to the Kidneys and which alone he called χυλὴν, Cava, though others also gave the same Name to that which rises upwards to the Heart, through the Septum Transversum. So ARETÆUS likewise calls it and says, that both these are only a Continuation of one and the same Vein. The Veins rise from the Liver, as from their common Root, and receive the Blood they contain from it. From the Porta of the Liver,  
betwixt

betwixt its Extremities, a large Vein arises, which, dividing itself still more and more, is at last dispersed through the Liver, in Veins so small and minute, as to become invisible.

The Extremities of these Veins are inserted, into the Orifices of others, which, growing gradually larger, and fewer in Number, at last terminate in the Liver in one great Vein, which dividing itself again into two Branches, reach beyond the Liver. One of these Branches, penetrating the first Lobe of the Liver, again emerges into its gibbous Part; and having afterwards perforated the Septum Transversum, extends itself within the Breast, but adheres to no other Part; and being suspended there, is inserted into the Heart; this is called the Vena Cava. Another, penetrating through the fifth and inferior Lobe of the Liver, as far as its gibbous Part, goes out near the Spina, and runs along it to the Coxæ. This is also the Vena Cava; for it receives the same Name, because it is the same Vein arising also from the Liver: For if any one has a Mind, he may pass a Probe from the upper Part of the Vena Cava, which reaches to the Heart, into that Part of it which creeps along the Spina, and back again from the Spina, through the Liver, into the Heart, for the Passage is the same.

In this Vein, besides the above mentioned Inflammation, those Disorders which the Greeks called *Κόμματα*, arise; in which Case the Hæmorrhage consequent upon its Rupture, soon puts an end to the Life of the Patient.

The Blood is conveyed from all the principal Viscera to the hollow Vein at the Cubit; for this Vein, and that which lies above it, are Branches of one and the same Vein in the Arm: Hence it is of no greater Service to open the superior Vein, than this; for they are entirely ignorant of the  
Sources

## Iviii    An Historical Compendium.

Sources of the Veins, which appropriate the superior Vein to the Stomach and Liver. But if there should happen any Effusion of Blood from the Spleen, some Physicians order the Vein lying betwixt the little Finger and the ring Finger to be opened, because they imagine, that it reaches to the Spleen; but this is also a Branch of the inferior Vein of the Cubit. Why then should any one choose to open it so near the Fingers, since at the Beginning of the Elbow, it is much larger, and permits the Blood to flow out more readily.

The Work of Sanguification belongs to the Liver, which is the Source of the Veins; and for that Reason the greatest Part of it is no more than a certain Concretion of Blood; for as the Aliments have great Access to the Liver, and as there is no other way by which the Food is conveyed through the whole Body, from the Stomach and Intestines, so the Blood passes from this Bowel to all the Parts of the Body. This was also the Sentiment of ERASISTRATUS.

The Portæ Jecoris consist of Nerves and Membranes, which are indeed small of themselves, but of great Importance to the Functions of Life; and of large Veins, for which Reason they are very subject to small Inflammations. Besides, some Philosophers have affirmed, that the Appetites of the Soul were lodged in this Place.

Now the Bile is formed in the Liver, and is secreted by means of a Cystis or Bladder situated there for that Purpose, and afterwards is conveyed to the Intestines, by certain Ducts; and if they should be obstructed by a Schirrus, or an Inflammation, or if the Contents of the Bladder should overflow, the Bile returns backwards, and is mixed with the Blood, which flowing through the whole Body carries likewise the Bile along with it. Hence in Jaundices, the Skin seems, as it were, tinged with Bile, and  
the

the Excrements are white like Clay, and untinged with the Colour of the Bile, because none of that Humour flows to them. Hence also Icteric Patients are coltive, because their Bellies, are neither moistened nor stimulated by the Bile.

The Aliment of the Spleen is black, and the Spleen itself deterges and refines the black Blood. It is a Bowel of a rare Contexture, and of a dissolvable Nature, and for this Reason subject to Imposthumations and Abscesses.

The Stomach presides over Pleasure and Uneasiness, and because it is adjacent to the Heart, the common Source of all the Faculties; (for it is connected to the Middle of the Heart and Lungs, and with them adheres to the Spina Dorfi) it contributes very much to Strength, and to Composure or Dejection of Mind upon Account of its Consent with the Soul. This is the principal Faculty of the Stomach. From Pleasure arises a good Digestion, a full and fleshy Habit of Body, and a fresh and lively Colour. From Uneasiness the Contraries of these arise, and sometimes Dejection of Mind, when the Stomach is empty. The Disorders of the Stomach are properly speaking, Nauseas, Vomitings, Loathings of Food, Hiccoughs, Eructations, and these too sometimes acid; and though in People labouring under Disorders of the Stomach, it is generally free from Thirst, yet in it the Source and Origin of Thirst is contained.

The Colon also contributes to the Concoction of the Food, as well as the Stomach, and the Aliments are conveyed from it to the Liver: Neither do all the Aliments pass through visible Canals, for Nature distributes the far greater Part of them, through the whole Body by Vapours, which easily pass from one Part of the Body to another; and these very Vapours are also by Nature carried through the compact and solid Parts of the Body.

The



## lx An Historical Compendium.

The Colon is a very large Intestine, wide enough in all its Parts, and formed into Sinuses more thick and fleshy than the small Intestines, and more capable of bearing Injuries; for this Reason, when this Intestine is the Seat of Colic Pains, the Danger is the less: For when the small Intestines are affected, a sharp and pungent Pain is felt; but when the Colon is affected, there is great Abundance of Humours, and a Sensation of Gravity is perceived in it.

By Reason of its Situation and Connection, the Pain sometimes reaches to the Ribs, and makes a Pleurisy suspected; for even in the Colic, a Fever sometimes arises. Sometimes the Pain appears to be on one Side, sometimes on the other, under the spurious Ribs; so that the Liver or Spleen, seems to be affected, and the Pain falls down again to the Ilia. With some this Pain seizes the Os Sacrum, the Thighs, and the Cremaster Muscles of the Testicles; so that ARETÆUS, knowing the Reasons of these Symptoms, justly stigmatized the Ignorance of some Physicians, who, in this Case, cut off the Cremaster Muscles, as if they had contained the immediate Cause of the Disease. Now can any thing advanced by later Anatomists, possibly come nearer the Truth?

There are two Tunics of the Intestines, as well as of the Stomach, one of which lies obliquely upon the other. When therefore the Connection of these is dissolved, as it sometimes happens in Dysenteries, the interior Tunic, separating lengthways, is discharged by Stool, and strikes many, who are unacquainted with the true Cause, with a Dread of having lost their Intestine; and the exterior Tunic remaining within, incarns and cicatrizes, and then the Patient becomes sound; but the lower Intestine is only subject to this Accident, as having its Tunics of a fleshy Nature.

The

The Kidneys are naturally glandular Bodies, of a reddish Colour resembling rather the Liver, than the Breasts and Testicles. These are Glands, but they are whiter than the Kidneys. The Kidneys indeed resemble the Testicles in Figure, but they are broader, more crooked, and contain small Sinuses, with narrow Necks, for percolating the Urine. From these, two small Nervous Canals, resembling little Pipes, branch out, which are called the Ureters, and are inserted in the Sides of the Bladder on each Side, and from both Kidneys there is an equal Conveyance of the Urine to the Bladder. Nature has formed the Sinuses of the Kidneys oblong, and by that Means adapted them to the Diameters of the Ureters, which are but small.

The Bladder is of a very inconsiderable Thickness, and naturally of a nervous Texture; for which Reason, it neither incarns nor cicatrizes easily. When it is full, it is distended, and when empty, it collapses; so that in Case of an Ulcer, it suffers just as much as a Joint does, in Extension and Contraction. Now all Ulcers upon the Joints are cured with the greatest Difficulty. Besides, bilious Urine and an inveterate Ulcer must necessarily corrode the Bladder.

The Anus and Bladder are contiguous to each other, and for this Reason, in Inflammations of the Rectum, the Bladder with Difficulty discharges its Contents; and in Disorders of the Bladder, the Fæces are not discharged even though the Belly should not happen to be costive.

Certain Membranes are affixed to the Ilia, which are nervous Ligaments of the Uterus; these Membranes, which are inserted in the Bottom of the Uterus, hard by the Loins, are small and slender; the others towards its Neck, and which, adhere here and there to the Ilia, are very nervous, and spread much after the Manner of the Sails of a Ship.

Now

## Ixii An Historical Compendium.

Now if all these Membranes are relaxed, the Uterus falls out of its Place. Sometimes the interior of the two Membranes, which surround the Uterus appears, and may be separated from the other; for only two of its Membranes can possibly be divided, one of which recedes from the other, by Reason of the Fluxion of Humours, as it happens likewise in Miscarriages and hard Labours, in which Case it adheres to the Chorion; for if that is forcibly extracted, the Tunic of the Uterus comes along with it; but if the Woman escapes Death, and if it returns to its proper Situation, it reunites exactly, or else hangs a little out. Sometimes the Mouth of the Uterus, falls out only as far as its Neck, but it is easily restored, if Fumigations are used, and the Midwife uses proper Endeavours to replace it gently, and by Degrees.

The Head is the Origin of the Senses and Nerves, and rather attracts the Blood from the Heart, than conveys it to other Membranes.

When therefore the Cause of any Disorder is lodged in the Nerves, the Senses must be injured. Though the Nerves arise from all Parts of the Head, yet the anterior Part of the Head, is the Store-house as it were, of all the Senses, and from it all Aids and Injuries are derived. For this Reason in applying Fomentations, we ought to proceed no farther than the Vextex.

ARETÆUS following the Opinion of ERASISTRATUS, maintained, that the Nerves were not only the Origin of Sensation, but the Source of all Action and Motion of the Members. So that if the Origin of any Nerve below the Head is affected, as the Membrane or Meninx of the Medulla Spinalis, the Parts which come under the same Denomination, and also those which are contiguous, become paralytic; the Parts on the right Side if that Side be hurt; and those of the



the left, if the Nerves on that Side should happen to be injured. But if the Cause of the Disease be lodged in the Head, if the Nerves on the right Side be affected, the Parts on the left Side will be paralytic, and Vice Versa. The Reason of this Phænomenon is, that the Nerves change Sides near their Origin ; for those on the right Side do not go directly all the way to the Parts on the right Side ; but both those on the right and left Sides, being inserted in their proper Origins, they immediately cross one another in the Form of the Greek Letter X, tending to opposite Parts. But whether the whole Body, or some of its Members, either on one or both Sides, are paralytic, the Nerves which arise from the Head, are sometimes affected, and in short are easily deprived of their sensitive Faculty, but do not of themselves so readily become incapable of Motion. These Nerves also, if by Consent they contract any Injury, from those destined for the Purposes of Motion, lose in some Measure their Capacity for Motion, with some Degree of which, though a very small one, they are naturally endowed. Sometimes also the Nerves arising from some Muscles, and terminating in others, are hurt ; and these are the Nerves which are chiefly capable of Motion, and convey it to the Nerves of the Head, which derive a great deal of their Motion from them, tho' they have some Degrees of it in themselves. These Nerves therefore suffer principally a Decrease of Motion, but they rarely, or never lose their sensitive Faculties ; and if at any Time, a Congeries of Nerves arising from any Bone, and terminating in another, should be either relaxed or broke, the Parts become impotent and contracted, but they are not deprived of Sensation.

According to ARETÆUS, a Tatanus is a Disease, incident to the Nerves, in which he also taught

taught, that the principal Cause of Melancholly resided ; he likewise thought, that they were affected, and often contracted in a Phrenitis ; and that in the Gout all the System of Nerves was affected.

These were the Notions maintained by ARETÆUS, with regard to Anatomy, which he made chiefly subservient to Physic, in accounting for the Symptoms and Causes of Diseases. In this, he imitated the Sect of Dogmatists, who maintained, that since Pains and Disorders of various Kinds were incident to the internal Parts, no one could apply Remedies to them, who was ignorant of their Structure. So that though the Notions of ARETÆUS concurred sometimes with those of HIPPOCRATES, ERASISTRATUS, or HEROPHILUS ; yet he was not the blind Votary of any Party, or the too fond Admirer of any Man ; but freely declares what he himself thought Truth. See WIGAN's Preface to ARETÆUS.

RUFUS EPHESIUS is the next anatomical Author of Note we meet with ; he lived under the Emperors NERVA and TRAJAN, and was esteemed a very skilful Physician by GALEN, who also informs us, that he wrote in Verse upon the Materia Medica. He also wrote a Treatise upon the Atra Bilis, or black Bile, and some other Pieces quoted by SUIDAS, but these have not reached our Hands ; for the only Remains we have of this Author, are several Parts of the human Body ; another on the Diseases of the Kidneys and Bladder, and a Fragment relating to purgative Medicines.

The principle Design of this Physician, in the first of these Works, was to give a general Idea of Anatomy, and to dissuade those who studied Physic in his own Days, from being deceived in reading the antient Authors, some of whom had described the Parts of the human Body, under one Set

Set of Names, and others of them, the same Parts, under quite different Appellations.

Besides, we may fairly gather, from what RUFUS advances in this Treatise, that, in his Days, all the anatomical Demonstrations were made upon Beasts.

“ Make Choice, says he, of an Animal as nearly resembling Man as you can possibly meet with.”

You will not find all the Parts of the Animal exactly, and in every Particular, like those of Man; but there will, at least, be some Analogy or Similitude betwixt them. “ Formerly, continues he, Anatomy was taught on human Bodies.”

We also learn, from the same Book, that those Nerves, which were afterwards distinguished by the Epithet RECURRENT, were but just then discovered. “ The Antients, says RUFUS, called the Arteries of the Neck, carotid or carotic Arteries; which Epithet, in their Language, implied Sleep-inducing: Because they imagined, that, when these Arteries were strongly compressed, the Animal was inclined to Sleep, and lost the Use of its Voice.” But in this Age we have discovered, that these Symptoms are not occasioned by the Compression of those Arteries, but by that of the Nerves which are contiguous to them.

It is also probable, that RUFUS observed certain Vessels of the Matrix, of which preceding Anatomists made no mention. “ HEROPHILUS, says he, did not believe that Women had any Parastatæ Varicosæ; but, upon examining the Matrix of a Beast, I have observed certain Vessels which arise from the Testicles, and which, being folded back upon both Sides in the Form of Varices, terminate in the Cavity of the Ma-

## lxvi An Historical Compendium.

“trix.” Upon compressing these Vessels, there even flows from them a glutinous Humour; and it is thought, that they are certainly feminal Vessels of the varicose Kind. RUFUS had before observed, that in Men there were four spermatic Vessels, two of the varicose, and two of the glandular Kind; and that the Extremities of the former, which adhered to the Testicles, were called *Paraſtatae*.

What he, in this Passage, calls *Paraſtatae Varicosa*, appear to be the same Things which are now called *Tubae Fallopianae*, from *FALLOPIUS*, the supposed Discoverer.

*GALEN* is the next and principal Anatomist of Antiquity: To him we are obliged for most we know, with respect to the Anatomy of the Antients. As a complete Extract of his Works, on this Subject, would be too voluminous, we will in this Place only give some general Remarks on his Anatomy.

He maintained, That the *ASCLYPIADÆ*, or Descendants of *ESCULAPIUS*, down to the very Days of *HIPPOCRATES*, who was one of that Race, were perfect Masters of Anatomy; but that none of that Family, except the last, had wrote any Thing upon that Subject. The Reason of their not writing was, that their Children, to whom alone they communicated their Art, learned Anatomy immediately under themselves, almost as soon as they learned the Letters of the Alphabet; and that by seeing Dissections (such as were practised in those Days, which I think were very imperfect) made, and making them themselves; so that they had no Occasion for Books to instruct them in this Art.

“It afterwards happened, says *GALEN*, that  
“*HIPPOCRATES*, having wrote on Anatomy, as  
“well as the other Branches of Physic, and hav-  
“ing

## An Historical Compendium. lxvii

“ ing first made Strangers his Disciples, Anatomy began to decline apace ; because the Physicians who came after him satisfied themselves with reading his Books, without taking the Pains to dissect themselves.”

DIOCLES, who came almost immediately after HIPPOCRATES, wrote also on the same Subject, but in such a Manner, as discovered abundance of Ignorance.

Things remained in this Situation till the Death of DIOCLES, which happened much about the Time in which HEROPHILUS and ERASISTRATUS appeared.

These two Physicians applied themselves industriously to Dissections ; and had, for that Purpose, as many human Subjects as they desired : So that they soon re-established Anatomy, which had been neglected during the above mentioned Interval. But the Anatomists of succeeding Ages had not the same Opportunities of dissecting human Bodies, the Reasons for which are enumerated at Length by RIOLAN.

“ Most human Bodies, says he, were burned immediately after Death : There was a Law enacted at Rome, in Consequence of the Disorder which reigned during the Civil War that happened under MARIUS and SYLLA, which discharged and prohibited the committing any Outrages on the Bodies of the Dead.” We also know, that, in the Days of Antiquity, People were not only afraid of touching, but even of coming near, human Carcasses ; and for that Reason the Vespillones, or those who interred the Dead, and even the Coriarii, or those who prepared the Skins of Beasts, had their Dwellings without the Gates of Rome : Nor had the public Executioners any Residence in it ; for the Romans were so delicate in this Point, that they

## lxviii An Historical Compendium.

would not so much as allow any one to be punished within their Walls.

The Laws of the Jews, relating to those who touched dead Bodies, are too well known to stand in Need of an Enumeration; but every one does not know that the Sentiments of the Greeks, with regard to this Point, were the same of those with the Jews. This RIOLAN proves by a Passage from the IPHIGENIA of EURIPIDES.

“ If any one, says that Poet, stain his Hands  
“ by Murder; if any one touch a Carcass, or a  
“ Woman immediately after Child-birth, the  
“ Gods discharge him from their Altars, as impious and profane.”

The Difficulty which there formerly was, of finding human Bodies for Dissection, appears from a Passage of PLINY (Lib. xxviii. Cap. 2.) to the same Purpose; where he says, that it was against the Laws to look into the Entrails of Men.

But these Authorities, and all the others brought by RIOLAN, cannot hinder him from thinking, that, in all Ages, Physicians have fallen upon the Means of procuring human Bodies for Dissection.

This he endeavours to prove by a Passage of PLINY (Lib. xix. Cap. 5.), where he says, that the Kings of Egypt, in antient Times, opened the Bodies of the Dead, in order to know of what Distempers they died. The Egyptians also used to embalm their Dead, which they could not possibly do without opening them. There were at Alexandria \* human Skeletons, by which means, young Physicians learned to know the Bones.

We read in RUFUS EPHESIUS, that the Physicians, who lived before him, had learned Anatomy upon human Bodies; and the Accounts

---

\* GALEN. Administrat. Anatom. Lib. i. Cap. 2.

## An Historical Compendium. Ixix

handed down to us of HEROPHILUS and ERASISTRATUS, will not allow us to doubt of it. GALEN \* pronounces, concerning the first of these Physicians, that he had acquired a very exact Knowledge of Anatomy by dissecting Men, and not Beasts, as most other Physicians used to do.

SENECA, according to RIOLAN, affirms†, that Physicians opened the Bowels of Men, in order to discover the Causes of their Diseases; and that, even in his Time, they dissected the several Parts of Bodies, in order to know the Situation of the Joints and Nerves. But in the common Edition of SENECA there are only these Words; *Medici, ut vim ignoratam Morbi cognoscerent, Viscera Hominum resciderunt*: “ Physicians, “ that they might know the hidden Natures of “ Diseases, opened the Bowels of Men.”

NOW SENECA, according to RIOLAN, lived in the Days of AUGUSTUS, TIBERIUS, and NERO; and the Roman Physicians were allowed to dissect the Bodies of their Enemies, which, in Reality, they did during the Wars of MARCUS AURELIUS against the Germans, as GALEN informs us: It was also no difficult Matter to procure the Bodies of such as were put to Death at Rome, since they remained uninterred without the Esquiline Gate, now called the Porta di S. LORENZO. The Bodies of exposed Children might have also been easily obtained. In short, since, in these Days, Masters had great Numbers of Slaves, who could hinder them from using any Liberties with the Carcasses of these poor Creatures, which they themselves should judge proper?

---

\* De Dissect. Vulvæ, Cap. 5.

† Medicos ut vim ignoratam Morbi cognoscerent, Viscera rescidisse; hodie Cadaverum Artus rescindi, ut Nervorum articulorumque positio cognosci possit.

RIOLAN might have subjoined to all these Proofs what CICERO says\*: “ We know not our  
 “ own Bodies; we are ignorant of the Situation  
 “ of the Parts, and unacquainted with the Pow-  
 “ ers of each particular Member. For this Rea-  
 “ son, the Physicians themselves, whose Interest  
 “ it was to be thoroughly versed in these Things,  
 “ dissected human Bodies, with a View to dis-  
 “ cover them: But, say the Empirics, they are  
 “ not, by that means, better understood or com-  
 “ prehended by us; because it is possible, that,  
 “ so soon as they are discovered and exposed to  
 “ View, they may assume a Nature different to  
 “ what they had before.”

The same RIOLAN having proved, in general, that the antient Physicians sometimes dissected Men, endeavours to shew, in a particular Manner, that HIPPOCRATES, ARISTOTLE, and GALEN, did so too. As for the two first, they come not under our Consideration at present. I shall therefore only enquire a little into the Truth of his Pretences with regard to GALEN, in whose Favour he stands up against some Moderns, who have maintained the contrary. “ People, says  
 “ he, have no Reason to accuse GALEN of never  
 “ having dissected human Subjects, and of hav-  
 “ ing taught the Anatomy of an Ape instead of  
 “ that of a Man. I could easily prove, by a  
 “ great many Quotations from this Author, that  
 “ he has dissected both Apes and Men; but that  
 “ he has only taught the Anatomy of Man.”

Upon this Occasion he cites two or three Passages from GALEN, by which, indeed, it appears, that this Author treats, or at least says he treats, of the Anatomy of Man: And in one

---

\* Academic Quest. Lib. iv.



Passage he even promises to publish separately the Anatomy of some other Animals.

The Words of this last mentioned Passage run thus: “ I have not here a Design to enumerate  
“ the Number of Lobes which make up the Li-  
“ vers of other Animals, because I have not, as  
“ yet, described the particular Structure of any  
“ of their Organs, except in some Passages,  
“ where I have been obliged to do it in order to  
“ illustrate what I say concerning Man: But, if I  
“ live, I shall, some Time or other, describe the  
“ Structure of the Bodies of Beasts, and furnish  
“ out an exact Anatomy of all their Parts, as I  
“ have now done with regard to the Parts of  
“ Man.”

RIOLAN quotes another Passage, wherein GALEN, when talking of some Anatomists of his Days, says, that “ It was no Wonder if they  
“ were deceived, since they only dissected the  
“ Hearts and Tongues of Oxen; never consider-  
“ ing, at the same Time, that these Parts are not  
“ in those Animals the same as they are in Men.”

One may reasonably suppose, that if GALEN had not himself examined those Parts in Man, he would not have been so forward in censuring those who had not done it more than himself.

After the Passage in which GALEN commends HEROPHILUS for learning Anatomy by dissecting Men, he adds, that “ most other Physicians dis-  
“ sected only Beasts.” This Passage proves, that HEROPHILUS was not the only Anatomist who dissected Men: If none, except he, had done so, our Author, instead of these Words, “ most  
“ other Physicians,” should have said, “ all other  
“ Physicians.”

Now if some of the Physicians of his Time dissected human Bodies, it is very probable, considering the Fondness he discovers for Anatomy,

## Ixxii An Historical Compendium.

that he was not idle in this Respect, whilst others were labouring to improve themselves. I believe then, as well as RIOLAN, that GALEN may possibly have dissected human Bodies; but it is probable he did so very rarely, and perhaps but imperfectly too.

What has already been said upon this Head proves, that the Thing could not be undertaken without a great deal of Difficulty; and in this Sentiment GALEN himself confirms us, by the Pains he is at in speaking of several other Methods in which he thought Anatomy might be learned. He advises \* to make Choice of that Species of Apes which bear the nearest Resemblance to Man; or if such, continues he, cannot be found, we must dissect those whose Heads resemble that of a Dog, or Satyrs, or Lynxes. If these Animals should still be wanting, we must make Use of Bears, Lions, Weasels, or Cats; because these Animals have a kind of Fingers resembling those of Men.

He goes on thus: “ I have never made an Attempt to dissect Ants, Gnats, Fleas, or any such minute Insects; but I have often dissected Weasels, Rats, Serpents, and several Species of Birds and Fishes; by which I have discovered, that the same Principle of Intelligence is employed in the Formation of all Animals, every one of which has the Structure and Mechanism of its Body adapted to the State and Condition of its Nature.”

It also appears that GALEN sometimes dissected Hogs and Goats: And he himself † speaks of an Elephant, the Whole, or at least some Parts of which, he had dissected at Rome.

---

\* Anatom. Administrat. Lib. vi. Cap. 1.

† Ibid. Lib. vii. Cap. 10. De Usu Part. Lib. xvii. Cap. 1.

It will, no doubt, be said, that our Author advised to begin with dissecting Beasts, and to finish and perfect our Knowledge by dissecting Men. All this is true; but let us see in what Strain he talks of this Affair. “ I advise you, says he\*,

“ first to exercise yourself thoroughly upon Apes;

“ that, if you should find an Opportunity of dissecting a human Body, you may be able readily to discover and know each Part of it; in

“ which Case, you will be foiled in your Attempts, unless, before-hand, you have frequently exercised yourself upon other Subjects.”

For want of such a previous Exercise, those who dissected the Bodies of the Germans, during the War undertaken by that People against MARCUS AURELIUS, reaped no other Advantage from their Labours than a Knowledge of the Situation of the Viscera: But a Physician who has before tried his Hand upon other Animals, and especially Apes, at once sees the Peculiarities of the Parts he dissects. It is easier for a Man of Skill and Practice in Anatomy with a single Glance of his Eye to discover what he has elsewhere seen before, than for a Novice in the Art to perceive even the most evident Things at his greatest Leisure.

Many of this first Class of Men have very quickly discovered what they wanted to see, upon the Bodies of those who were condemned to Death, or exposed to the Fury of wild Beasts, or upon the Bodies of Robbers, who were denied the Privilege of Burial. Besides, large Wounds, or deep and hollow Ulcers, have sometimes discovered; to these Men of Skill, many Parts of the human Body resembling those they had formerly seen in Apes; whereas those who had never en-

---

\* Administrat. Anatom. Lib. III. Cap. 5.

## Ixxiv An Historical Compendium.

deavoured to improve themselves upon those Animals, could reap no Advantage upon Occasions of this Nature.

Those who have frequently dissected the Bodies of exposed Children well enough know, that the Bodies of Apes and Men very much resemble each other. It is not to be doubted but GALEN employed some of those Means, or others of a like Nature, in order to instruct himself in Anatomy; and the Anatomy acquired in this Shape was by him styled *Ἀνατομὴ κατὰ περίπλοσιν*, or Anatomy acquired by Accident; which was the only Kind approved of by Empirics. That GALEN enjoyed Opportunities of this Nature is plain, from another Passage; where, after having advised young Physicians to travel to Alexandria, in order to see the Skeletons, and not to satisfy themselves with what they read in Books upon that Head, he adds these Words:

“ I have often examined the Bones of Men,  
“ when Sepulchres or ruined Monuments have  
“ fallen in my Way. A Sepulchre, slightly built  
“ upon the Brink of a River, happened to be  
“ destroyed by the Impetuosity of the Torrent,  
“ which had overflowed it; so that the Body,  
“ which had been laid in this Sepulchre, being  
“ carried off by the Current, stopped, at last, in  
“ a Place not unlike a Harbour, surrounded with  
“ pretty high Banks. I had an Opportunity of  
“ seeing this Body, the Flesh of which was already rotten, but the Bones were still connected with one another; so that one would  
“ have said, it was a Skeleton prepared for the  
“ Instruction of young Physicians. One Day I  
“ also saw the Carcass of a Robber lying on a  
“ Mountain, far enough from any public Road:  
“ This Robber was killed by a Traveller, whom  
“ he had attacked; and the Inhabitants of the  
“ ad-

“ adjacent Parts refusing to bury him, because  
 “ they judged a Man so wicked the proper Prey  
 “ of Vultures; his Bones were, two Days after-  
 “ wards, stripped of all their Flesh, and dry,  
 “ like those prepared for the Instruction of Phy-  
 “ sicians.”

GALEN speaks also, in the same Chapter, of a Disease, attended with Carbuncles, that had raged in most of the Cities of Asia, and afforded him Opportunities of examining the Situation and Disposition of the Muscles of several Parts that were stripped of the Skin, and some Part of the Flesh.

If our Author confined himself to the Methods above specified, he surely cannot be said to have made complete and regular Dissections of the human Body. Among all the Subjects, from which he says Anatomy may be learned, none, except the exposed Children, seem calculated for furnishing him with the Materials of a complete Anatomy; because it was no difficult Matter to carry off some of these little Bodies, and afterwards dissect them, with the Leisure necessary for that Purpose. And this, in my Opinion, he himself seems to insinuate, when he says, that “ those  
 “ who frequently dissect exposed Children, well  
 “ enough know that the Body of Man very much  
 “ resembles that of an Ape.”

If Dissections of this Nature were often made in the Days of GALEN, as we may gather from this Passage, it is probable that he, like others, employed himself in this Way, tho’ a Principle of Caution might restrain him from making a public Declaration of it, on Account of the Aversion that then reigned in the Minds of People against Practices of that Nature.

It may be said, that it was not much more difficult to get some of the Bodies of executed Criminals carried off; but he no-where insinuates,  
that

## lxxvi An Historical Compendium.

that any one made the least Attempt of this Kind. For when he speaks of what was learned by examining the Bodies of Robbers, or other Carcasses casually found in the Fields; he informs us, that this Examination was made upon the very Spot where such Bodies were found, by endeavouring, as soon as possible, to discover the Part or Circumstance sought for. This may be gathered from the Passage already quoted; where he says, that “those who have dissected Apes, are able speedily to inform themselves, by means of the Carcasses they find in the Fields, with regard to the Disposition of those Parts, which they may have formerly seen by dissecting Animals.” In the Course of this Passage he three or four Times repeats the Word speedily, which expresses the Shortness of the Time that he himself, or any Body else, had to view the Parts of the Subjects we are now speaking of; for Fear, no doubt, of being surpris'd in an Action that must have struck Terror to the Spectators, and must be owned to be, in its own Nature, none of the most agreeable.

In short, the Pains GALEN is at to specify all the other Means of learning Anatomy, which we have mentioned, sufficiently prove, as we have already observed, that, in these Days, regular Dissections of the human Body could be made but very rarely, and with a great deal of Difficulty. A collateral Proof of this is, that such Dissections were not publickly made in the Schools of Physicians; for we may well suppose, that, if they were made in any Part of the World, it must have been at Alexandria, the Capital of Egypt, where the Custom of opening the Dead, in order to embalm them, might have been supposed, in some measure, to reconcile and inure them to the Horror that attends a complete Dissection: But

we

we do not find that any Thing of this Nature was practised there since the Days of HEROPHILUS and ERASISTRATUS, or of the antient Kings of that Country. All that was done, in this Respect, even in that famous Medicinal School which flourished in the Days of GALEN, was, to teach OSTEOLOGY upon human Skeletons, which might have been very antient.

If the Masters of this School had exhibited, upon human Subjects, all the other Parts of the Anatomy of Man; GALEN, and a great many other Authors, had not failed to acquaint us with it, in numberless Passages.

As for those Passages, from many Authors, which have, since the Time of RIOLAN, been advanced to prove, that, in the Days of Antiquity, human Dissections were practised; it is easy to shew, that almost all of them have a Reference to what passed long before the Times in which these Authors wrote; and that the Accounts handed down, of HEROPHILUS and ERASISTRATUS, might have laid a Foundation for all that has been said on that Subject.

But to return to GALEN: Taking it for granted, that he dissected some human Bodies; yet nothing is a more convincing Proof of his not having dissected a sufficient Number, than his describing, in several Passages, the Parts of Apes, or some other Animals, instead of those of a Man. This has been clearly shewn by VESALIUS; and those who have maintained the contrary, have been miserably blinded and misled by their superstitious Attachment to GALEN.

But tho' GALEN has sometimes confounded the Parts of Beasts with those of Men, his Anatomy is, nevertheless, a very valuable Work; and VESALIUS himself had a high Veneration for it: And, indeed, it must be owned, that nothing

## lxxviii An Historical Compendium.

could set the Merit of its Author in a fairer or truer Light than this Piece; if it be true, as he says, that no one had wrote well on Anatomy before him; and that he had made many important Discoveries in this Branch of Physic.

It is indeed possible, that, considering his Attachment to Anatomy, he might have made some Discoveries of his own in that Science; though, at the same Time, his Propensity to commend himself, must render every Thing he says, concerning himself, suspected. But the Truth is, whether he was the first who placed Anatomy on a good Foundation, or whether he raises his own Character on the Labours of others; from which, at the same Time, he has not drawn all the Advantage that could have been wished; yet still it is very certain, that we should have suffered very considerably, if all his anatomical Works had been lost; since they are the only remaining Monuments of all that the Antients wrote upon this Subject: For what else we find, of that Nature, is scarce worth Notice, if we except what ARISTOTLE has given us upon that Head.

It is true, GALEN had not attained to Perfection; neither can the Moderns pretend to it: And it is probable, that, without those Lights with which he supplied the very Men who have censured him, we should have still been in the Dark, with regard to a great Part of that which he has clearly demonstrated. His two principal Treatises of Anatomy are, Anatomical Administrations, and The Use of the Parts of the Human Body. The former contained fifteen Books, of which the six last are lost; the latter, which we have complete, contains seventeen. We have also a Book of his that treats of the Bones in particular; another, on the Dissections of the Muscles; a third, on the Dissection of the Nerves,  
which



which is imperfect; a fourth, on the Dissection of the Veins and Arteries; a fifth, in which the Author proves, in Opposition to ERASISTRATUS, that there is Blood in the Arteries; a sixth, on the Anatomy of the Matrix; a seventh, on the Organ of Smelling; an eighth and ninth, on the Usefulness and Causes of Respiration; a tenth and eleventh, on the Motion of the Muscles; a twelfth, on the Formation of the Fœtus; and two others, concerning the Semen; without taking into the Account what we find concerning Anatomy in his Books on the Natural Faculties, and elsewhere, dispersed in his other Works. GALEN wrote several other Books, that are lost; in some of which he treated of the Anatomy of HIPPOCRATES; and, in others, of that of ERASISTRATUS: In a third Work he treated of the Dissection of dead Bodies; and, in a fourth, concerning that of living Animals.

It were to be wished, that all these had reached our Hands, especially those Pieces relating to the Anatomy of HIPPOCRATES and ERASISTRATUS; as also the Abridgments he made of the anatomical Works of LYCUS and MARINUS; the latter of whom wrote twenty Books, which were abridged by GALEN, and of which he has preserved the Titles, which are so curious, as to lay a just Foundation for our lamenting the Loss of so great a Work.

But tho' we have not all the Works of GALEN, yet those we have, happen luckily to comprehend almost the Whole of his Anatomy: And if his Anatomical Administrations are not complete, the other Books we have mentioned, and especially those concerning the Use of the Parts, supply that Defect: For this Book, on the Use of the Parts is a Master-piece, has been justly admired in all Ages, and sufficiently discovers the Extent  
of

of its Author's Genius; since in it the Physician, as well as the Philosopher, may find Satisfaction. But what, in a particular Manner, strikes Christians with Admiration, is, that GALEN, tho' a Heathen, acknowledged One God, All-wise, All-good, and All-powerful; the Creator of Man, and all other Animals.

The Words he uses in one Passage of this Book\*, have not only strong Sense, but also somewhat of a divine and striking Energy in them. " In writing these Books, says he, I compose a true and real Hymn to that awful Being who formed us all; and, in my Opinion, true Religion does not so much consist in sacrificing many Hecatombs on his Altars, or in making him rich and costly Presents of the most fragrant and exquisite Perfumes, as in being persuaded ourselves, and endeavouring to persuade others, that he is possessed of unerring Wisdom, irresistible Power, and all diffusive Goodness. For his having ranged all Things in that Order and Disposition which is best calculated for the Continuation of their respective Beings, and his having condescended to distribute his Favours to all his Works, is a glaring Proof of his Goodness, which calls aloud for our Hymns. His having found the Means necessary for the Establishment and Preservation of this beautiful Order and Disposition, is an incontestable Proof of his Wisdom; as his having done every Thing he pleased, is of his Omnipotence."

It is not in one Passage, only, that GALEN talks in this exalted Strain; these are so much the genuine Sentiments of his Heart, that he loses no Opportunity of inculcating them; and confusing,

---

\* De Usu Part. Lib. iii. cap. 10.

## An Historical Compendium. lxxxii

at the same Time, the Epicureans; who maintained, that this beautiful and harmonious Frame of Nature was the blind Result of a fortuitous Concourse of Atoms. It is true, that he \* opposes MOSES for having maintained, that the Will or sole Command of God was the only Cause of all Things: GALEN does not admit of this Principle of MOSES, unless the Will of God be taken in Conjunction with the Choice that he made of the most proper Materials for answering the particular Ends he had proposed to himself, after having known what was really best, with regard to the Arrangement of each Body: “ For, says our  
“ Author, God could not have formed Man out  
“ of a Stone, nor an Ox or a Horse out of a  
“ Parcel of Ashes.”

GALEN did not reflect, that; as God was the Master and Creator of Matter; so his Will was sufficient to make any Part of it assume that particular Form, and all those other Modifications, that were requisite for answering his Ends.

If EPICURUS, bewitched as he was with his Atoms, had acknowledged the supreme Cause of their Arrangement, he would have reasoned better upon this Subject than GALEN; but GALEN was misled by PLATO, or ARISTOTLE, and not by EPICURUS.

THEOPHILUS PROTASPATARIUS, or rather PROTASPATHARIUS, a Greek anatomical Author, lived, according to FABRICIUS, in the Time of the Emperor HERACLIUS. He was, undoubtedly, a Christian, and probably a Monk, as he is styled in some antient Manuscripts.

He wrote five Books, *Περὶ κατασκευῆς ἀνθρώπινου σώματος*, of the Fabric of the human Body; in

---

\* De Usu Part. Lib. xi. Cap. 14.

## lxxxii An Historical Compendium.

which he is said to have epitomized excellently, GALEN Of the Use of the Parts; and, besides, mentions some Things not to be found in any preceding Author. Thus he asserts, that the first Pair of Nerves, arising from the first Ventricles of the Brain, is extended to both the Nostrils; and that, by means of these, Smells are conveyed to the Brain.

Thus, also, he says, that two Muscles are concerned in shutting the Eye-lids; but that they are opened by one only. According to him, the Substance of the Tongue is muscular.

He also first described a very strong Ligament, that is common to, and fixes, all the Articulations of the Vertebræ. This Passage is very remarkable: And, as it may serve as a Specimen of his Work, I shall insert it\*.

“ But as it is necessary for a Man to bend himself forwards and backwards, it did not seem sufficient to the good Providence of God to furnish each particular Articulation of the Vertebræ with proper Ligaments; which, however, are very necessary, and of great Use: But, besides these, is added, on the Outside of the Spine of the Back, a Ligament of a yellow Colour, and of a nervo-cartilaginous Substance, as a common Ligament to all the Articulations of the Vertebræ of the Spine.”

It is probable, that this Author also knew, that the Substance of the Testicles is vascular: For he

---

\* Ἐπειδὴ δὲ καὶ κύπτειν ἐμελλεν ὁ ἄνθρωπος, καὶ ἀνανεύειν, ἐχ' ἤκιστα ἢ ἀγαθὴ τῷ Θεῷ πρόνοια εἰς μόνους τὰς καλὰ μέρη συνδέντας δέσμευε τὰς σπόνδυλους ἀναγκάια γὰρ ἐστὶ καὶ ἰσχυρὰ ἡ χρεια· ἀλλ' ἐξωθεν μὲν τῆς ἀκάνθης τῆς ράχιδος, ἐπέθηκε σύνδεσμον ξανθὸν μὲν τῇ χροίᾳ νευροχονδρώδη δὲ τῇ ὕδατι ἀπὸ κέφαλῆς ἄκρας συνδέντα ἀπάδας διαβρώσεις τῶν σπόνδυλων κοινὸν σύνδεσμον.

## An Historical Compendium. lxxxiii

takes Notice of a prodigious Number of capillary Vessels, as fine as a Spider's Web, which, he says, are dispersed in the glandular Substance of these Parts.

This Work of THEOPHILUS was published at Paris, in Greek, in 1555, Octavo. Dr. DOUGLAS informs us, that it was also published in Greek at Paris in 1540; but I am afraid this is a Mistake: For Vander LINDEN and FABRICIUS inform us, that the Paris Edition of 1540 is only the Latin Translation of JUNIUS PAULUS CRASSUS: But, as I have never seen this Edition, I cannot determine it. FABRICIUS has given this whole Treatise, in Greek and Latin, at the End of the twelfth Volume of his Bibliotheca Græca. The above mentioned Translation was also published at Venice in 1536, Octavo; at Basil in 1539, Quarto; and, with some other Authors, at Basil in 1581.

ORIBASIUS, who, in two large Books, has described all the Parts, then known, of the human Body; and assigned the proper Office to each of them: But he has added little to what GALEN has discoursed of in his anatomical Works; and, on Account of this Treatise, rather than any other of his Writings, he deserves the Name given him of Simia GALENI, the Ape of GALEN. Only one Thing we find, that is either omitted by GALEN, or lost, together with some other of GALEN's Works, the first Description of the salivary Glands, which is this: " On each Side of the  
" Tongue lie the Orifices of the Vessels that discharge the Spittle, and into which you may put  
" a Probe: These Vessels take their Rise from  
" the Root of the Tongue, where the Glands  
" are situated. They rise from these Glands in  
" much such a Manner as Arteries usually do,  
" and convey the salivary Liquor that moistens  
e 2 " the

## lxxxiv An Historical Compendium.

“ the Tongue, and all the adjacent Parts of the  
“ Mouth.” See ORIBASIVS.

NEMESIUS is a Writer whose Name must by no means be omitted in a History of Anatomy. He was Bishop of Emiffa, a City of Phœnicia, at the latter End of the fourth Century; and wrote a Treatise, *Περὶ φύσεως ἀνθρώπου*, Of the Nature of Man, of which there have been the following Editions: Antwerpæ, 1565, Octavo, in Greek, with the Latin Translation of NICASIVS ELLEBODIVS. Oxon. 1671, Octavo, Greek and Latin. Vander LINDEN and DOUGLAS mention an Edition at Antwerp 1584, Octavo, but FABRICIVS takes no Notice of it. A Latin Translation, by GEORGIUS VALLA, was printed at Antwerp 1538; and an English Translation was printed at London 1636, Octavo.

As to the anatomical Discoveries of NEMESIUS, Dr. FREIND makes the following Reflections: “ The Oxford Editor ascribes two Discoveries to  
“ him, one of which was the most considerable  
“ that ever was made in Physic. The first is concerning the Bile, which is constituted, as NEMESIUS says, not only for itself, but for other  
“ Purposes: For it helps Digestion, and contributes to the Expulsion of the Excrements;  
“ and therefore it is, in a Manner, one of the  
“ nourishing Powers: Besides, as a vital Faculty,  
“ it imparts a Sort of Heat to the Body. And,  
“ for these Reasons, it seems to be made for itself.  
“ But, because it purges the Blood, it seems to be  
“ formed for the Sake of the Blood.” “ Here,  
“ says the Editor, the System of the Bile is plainly  
“ and accurately delivered; that very System  
“ which SYLVIVS DE LE BOE, with so much Vanity, boasted he had invented himself.”

And,

## An Historical Compendium. lxxxv

And, indeed, so far is true, that here is the true Foundation of SYLVIVS's Reasoning: And, if this Theory be of any Use in Physic, NEMESIUS has, I think, a very good Title to the Discovery. But there follows a much more material Point; and the Editor contends, that the Circulation of the Blood, an Invention that the last Century so much bragged of, was known to NEMESIUS, and described in very plain and significant Terms; which are these: " The Motion of  
" the Pulse takes its Rise from the Heart, and  
" principally from the left Ventricle of it: The  
" Artery is, with great Vehemence, dilated and  
" contracted, by a Sort of constant Harmony and  
" Order. While it is dilated, it draws the thinner Part of the Blood from the next Veins;  
" the Exhalations or Vapours of which Blood is  
" made the Aliment for the vital Spirit; but,  
" while it is contracted, it exhales whatever Fumes  
" it has thro' the whole Body, and by secret Passages; so that the Heart throws out whatever  
" is fuliginous thro' the Mouth and Nose, by Expiration."

Upon this single slender Proof does he attribute this great Discovery of the Circulation to NEMESIUS; and those who have insisted that it was known both to HIPPOCRATES and GALEN, have full as good Arguments on their Side. I will only say this, that from this very Description, and from what the same Author says of the Liver in the same Chapter, that it ministers Nourishment to the Body by the Veins, one may demonstrably infer, that NEMESIUS had no Idea of the Manner in which the Circulation of the Blood is performed.

It must be remarked, that, from the Time of GALEN to the Beginning of the fifteenth Century, Anatomy made but very slow Advances; for most

## lxxxviii An Historical Compendium.

corrected by CARPUS. It also appeared with KETHAM's *Fasciculus Medicinæ*, Anno 1500, Folio.

ALEXANDER BENEDICTUS flourished about 1495. He was a Native of Verona, cultivated Anatomy, and wrote a Book intituled *Alexandri, Benedicti. Physici, Anatomia, sive de Historia Corporis Humani*, Libri V. printed Basil, 1527, Octavo; Argent. 1528, Oct. Paris. 1514. His *Epist. Nuncupat.* was printed Venet. 1497. and his *Opera Medica* Venet. 1535, Folio; Basil, 1539, Quarto and Folio; Ibid. 1549, Folio. His *Historia Corporis Humani*, together with some of his Aphorisms, was printed in 1527, Duodecimo; but at what Place, is not mentioned.

He maintained, that the yellow Bile flowed from the Gall Bladder to one particular Part of the Stomach; and observed two Foramina near the urinary Passage in Women, which he falsely asserts to be the Orifices of Veins, and from which, he said, a certain Humour flowed, that was not prolific.

ALEXANDER ACHILINUS was a Native of Bologna. His Annotations on the Anatomy of MUNDINUS were published, together with the *Fasciculus Medicinæ* JOHANNIS DE KETHAM, at Venice 1522, Folio; and his Treatise *De Humani Corporis Anatomia* was published at Venice 1521, Quarto.

He is said to have discovered the Malleus and Incus of the internal Ear.

GABRIEL DE ZERIS, of Verona, flourished at the latter End of the fifteenth and Beginning of the sixteenth Century. His anatomical Pieces were published Venet. 1502. and 1533, Folio; and Marpurg. 1537. and 1545, Quarto; together with the Anatomy of MUNDINUS.

GUIDO DE CAULIACO was a Native of France, and studied at Montpelier under RAYMUND. He flour-



## An Historical Compendium. lxxxix

flourished in the Year 1363, at which Time he wrote a large Body of Surgery. His Works, under the Title of *Chirurgiæ Tractatus septem cum Antidotario*, were printed Venet. 1490, 1519, 1546, Folio; Lugd. 1572, Octavo; 1585, Quarto; Venet. 1499, Folio; Lugd. 1559.

He first taught, that Incisions about the Eyebrows should be made in the same longitudinal Direction with the Body itself, and not in that of the Rugæ of the Forehead; because the Muscles, that serve to move the Supercilia, run in the former, and not in the latter, Direction.

With regard to the Os Adjutorium, or Humerus, he advanced somewhat that had the Appearance of being new; but they may be more justly ascribed to GALEN, the great Restorer of Anatomy, as will plainly appear from his Works\*.

JACOBUS BERENGARIUS CARPENSIS was the great Reviver of Anatomy. He is distinguished with the Epithet CARPENSIS from the City Carpi in Italy; is likewise called CARPUS alone, JACOBUS CARPUS, and, by FALLOPIUS, JACOBUS CARPENSIS: But these three last mentioned Names he assumes to himself in his *Isagoge*.

He flourished in the Year 1522, and was Professor of Anatomy and Surgery in the University of Pavia. His Commentaries upon the Anatomy of MUNDINUS were printed at Bononiæ 1521, Quarto; his Anatomy was printed at Bononiæ 1523, Quarto; Coloniae 1529, Octavo; Argent.

---

\* I have not traced his Anatomy from its Origin to the fifteenth Century: But the Industry of the Revivers of this Science in the sixteenth, which had, from the Time of GALEN, lain, in a great Degree, uncultivated, will furnish us with more frequent and ample Discoveries; though it must be confessed, that many have been pretended to be made, which were known even in the Infancy of Anatomy.

## xc An Historical Compendium.

1533, Octavo; Venet. 1535, Quarto. His Practical Anatomy was translated into English by H. JACKSON, and printed at London 1664.

He was the first that used Uñction with Quick-silver, for the Cure of the *Lues Venerea*, and became immensely rich by his Practice that Way.

He first discovered the Ecphyfis, or Appendix of the Intestinum Cæcum, which he calls the ADDITAMENTUM COLI; and, under that Name, describes it at Length. He denies that the seven Cells of MUNDINUS are to be found in the Uterus, and admits only of one Cell or Cavity.

He was acquainted with the sublingual Glands, and their Ducts; and thinks, that the three Divisions in the Musculi Recti of the Abdomen are the Tendons of three Muscles, serving for the Contraction of the Abdomen.

He first discovered Caruncles in the Kidneys, resembling the Nipples of a Breast. That Line which now goes by the Name of Linea Alba, was by him called LINEA CENTRALIS, because it reached along the Middle of the Belly; and thought that the Proceffus Mammillares were not, on account of their excessive Softness, to be reckoned among the Nerves.

Concerning the Ear, he has these Words:  
“ Two little Bones are adjacent to this Mem-  
“ brane (he means the Tympanum), which, be-  
“ ing moved by the undulating Air, mutually  
“ strike each other, and, by their Motion, excite  
“ what we call Sound, in the Ear. This is the  
“ real Structure of the Parts, which, tho’ very  
“ remarkable, has yet been observed by few.”

He is therefore unjustly thought, by some, to be the Discoverer of these little Bones; since he assigns the same Use to them, that others have done before him: And, which is still more, he no-where pretends to be the Discoverer of them.

NICOLAUS MASSA was a Venetian by Birth, and flourished about the Year 1530. His *Liber Introductorius Anatomiae* was printed Venet. 1536, Quarto; 1559, Quarto. His *Epistolæ Medicinales* were printed Venet. 1542, Quarto; 1550, Quarto; 1558, Quarto.

RIOLAN, and some others, seduced by his Authority, ascribe the Invention of the Musculi Pyramidales to him; but they have nothing to support their Opinions: For that Muscle which is taken for the pyramidal Muscle of MASSA, is more properly called the cremaster Muscle, which it really is.

The Septum Scroti, which some Moderns boast of as their own Discovery, is elegantly described by him in these Words: “ This Bag (he means the Scrotum) has, besides, an intermediate Membrane, that divides the right Testicle from the left; so that the Scrotum has two Sinuses. Hence it happens, that it is sometimes distended on one Side by a Defluxion of Humours, or a falling down of the Intestines, whilst the other Side remains in its natural State.”

He denied the Existence of the Panniculus Hymenæus, which, according to MUNDINUS, blocked up the Mouth of the Matrix; and, in its Stead, maintained, that some Rugæ, mutually connected with Veins and Ligaments, were relaxed and broken, when a Woman was deflowered.

He described the Ducts of the renal Caruncles, thro’ which the Urine is strained, and which are now called the Tubuli Urinarii. CARPUS.

Concerning the Anatomy of the seminal Vessels, he expressly affirms, that the spermatic Vein and Artery do not at all meet, but pass separately to the Testicles; and demonstrates, that the Substance of the Tongue is muscular; and that it is covered with a double Skin.

## xcii An Historical Compendium.

He also asserted, that the Neck of the Uterus was muscular, and endowed with a voluntary Faculty ; takes the Membrana Frontis Carnosa for a real Muscle ; and asserts, that the Officula Auditus, which strike the Tympanum of the Ear, were known to Anatomists in the Time of ACHIL-LINUS.

JOHANNES GUINTERIUS is styled ANDERNACUS, because he was born in Andernacum, a Town of Ubich on the Rhine, in the Year 2487. His Works, under the Title of *Anatomicarum Institutionum ex Galeni Sententia, per Johannes Guinterium Andernacum Medicum, Libri quinque*, were printed Basil. 1536, Octavo ; 1539, Quarto ; Petav. 1538, Octavo ; Wirtemberg, 1613, Octavo : And his Piece, *De Medicina Veteri & Nova*, was printed Basil. 1571, Folio, 2 Vols.

He first called that glandular Body which is situated in the Middle of the Mesentery, and consists of a soft and yielding Substance, the PANCREAS ; and boasts of his being the Discoverer of the Complication of the spermatic Vein and Artery a little before their Insertion into the Testicles ; which, he says, was never observed before him ; and which, he adds, he shewed to VESALIUS, when he was studying Anatomy at Paris.

The Uterus, he said, had two Sinuses, corresponding to the Number of the Breasts, not divided by an intermediate Membrane, but terminating in one narrow Cavity, which he called the Neck of the Womb ; which Neck, he said, terminated at the Sinus Muliebris, which he also called the Pudendum.

He also admitted of the Membrana Allantos ; and asserts, that the Muscle which surrounds the Neck of the Bladder consists of transverse Fibres, and has various Offices. For, first, it shuts the Bladder ; and then, after the Discharge of the Urine,

Urine, contracting itself every way, propels what remains in the Meatus Urinarius.

LUDOVICUS BONNACIOLUS was a Native of Ferrara, and flourished about the Year 1530. His *Enneas Muliebris* was published Argentin. 1537, Octavo.

He first described the NYMPHÆ and CLITORIS as separate and distinct Parts, which had not been distinguished by the Antients; and said, that the Mouth of the Uterus resembled, in Figure, the Glans of the Penis.

The Testicles, according to him, were not perfectly spherical, but resembled a Sphere gently compressed on each Side.

ANDREAS VESALIUS was born at Brussels, a Town of Brabant, in the Year 1514. His superior Genius, in Conjunction with his indefatigable Application and Industry, soon raised him to such a Pitch of anatomical Knowledge, as rendered him, at once, the Ornament of his own, and the Admiration of future, Ages.

As it is the Fate of all Sciences to have their Votaries blindly and superstitiously attached to the Opinions of some particular Author of Note, till some daring Genius ventures to think for himself, and endeavours to make Authority fall a Sacrifice to Truth; so the Anatomists, at the Time VESALIUS appeared, were so much blindfolded with the Authority of GALEN, that, to have contradicted him, had been looked upon as Heresy.

VESALIUS, regardless of this unhappy State of Things, ventured to expose the Mistakes, and correct the Errors, committed by GALEN, both in Physic and Anatomy, especially the latter: But as there is a Principle of Emulation interwoven with the very Frame and Make of human Nature; so it must follow, that uncommon Merit must create, if not Enemies, yet, at least, Censurers, of Note  
and

## xciv An Historical Compendium.

and Distinction: This was the Fate of VESALIUS. Some distinguished Authors have charged him with Ignorance, Want of Honour, Vain Glory, and Plagiarism.

PICCOLHOMINUS, an Author of considerable Note, talks of him in this Strain: “ When a  
“ proper Opportunity occurs, I shall sufficiently  
“ shew, that whatever is good in that large Vo-  
“ lume, wrote by VESALIUS, *De Re Anatomica*,  
“ is borrowed from HIPPOCRATES, ARISTOTLE,  
“ GALEN, and some others of the Antients, with-  
“ out the Author’s so much as mentioning their  
“ Names; and that, whatever Things are false  
“ and erroneous, which, indeed, are very many;  
“ are the Product of his own Ignorance, and Im-  
“ petuosity of Temper. And tho’ he has secretly  
“ stole many Things from GALEN, yet he never  
“ mentions his Name, unless it be with a View to  
“ find Fault with him.”

The Censure of CAIUS upon VESALIUS, is still more remarkable. “ We both lodged, says he,  
“ in the same Quarters at Padua, at the Time  
“ when VESALIUS wrote and prepared his Book,  
“ *De Corporis Humani Fabrica*. One ALDINUS  
“ JUNTA, a Venetian Printer, employed him to  
“ correct the anatomical Works of GALEN, both  
“ Greek and Latin; and, for that Purpose, se-  
“ veral Emendations were sent him: But he ren-  
“ dered GALEN’s Text more corrupt than it was  
“ before, with no other View than that he might  
“ have somewhat to find Fault with.”

And tho’ FALLOPIUS owns him to be the Fa-  
ther of Anatomy, yet he carps at his Opinion  
almost every-where. COLUMBUS talks thus of  
him: “ I cannot but be surpris’d that he, who,  
“ on all Occasions, lashes and chastises GALEN  
“ for his having described Apes and Brutes, in-  
“ stead of Men; should yet, himself, be so ridi-  
“ culous,

“culous, as to describe the Larynx, Tongue, and  
 “Eyes, of Oxen, and not of Men; without so  
 “much as ever giving a Caution with regard to  
 “it. He also ascribed Muscles to the Epiglottis,  
 “which are only found in Brutes.” EUSTACHIUS  
 has also observed of him, that “He described  
 “and delineated a Dog’s Kidney, instead of a  
 “Man’s.”

ARANTIUS styles him the common Master of  
 Anatomists, but accuses him of having delineated  
 the Pudendæ of Brutes, on Account of the Scar-  
 city of the Bodies of Women; whereby it hap-  
 pened that VALVERDA, and those who immedi-  
 ately followed him, taking Things upon Trust,  
 split upon the same Rock.

JOHANNES BAPTISTA CARCAN. LEON. speaks  
 of him thus: “It is surprising that VESALIUS,  
 “whilst he accuses GALEN, the chief of Phy-  
 “sicians and Anatomists, of so many Blunders  
 “and Errors; should yet, himself, be so justly  
 “liable to Censure in the same Respect: And,  
 “what is still worse, by these his Accusations, he  
 “seems widely to have mistaken GALEN’s Mean-  
 “ing; ascribing to him Things he never so much  
 “as dreamed of; and affirming, that he denied  
 “those very Things that he insisted on in the most  
 “distinct and explicit Manner: And whilst he so  
 “often wonders at, and finds Fault with, GA-  
 “LEN; he himself deserves to be wondered at,  
 “and found Fault with.”

“The Style of VESALIUS, says RIOLAN, is  
 “ridiculously pompous, and his Periods by far  
 “too long; so that he generally throws a greater  
 “Degree of Darkness upon Things that are, of  
 “their own Nature, too obscure. Besides, I sus-  
 “pect, that the Latin of that Book is none of  
 “VESALIUS’s, but the Language of some other  
 “learned Man; since his *Chirurgia Magna*, his

“ *Examen Observationum Fallopii*, and his little Book, *De Radice Chinæ*, are wrote in a quite different Style.” And, for this Reason, FALLOPIUS thinks that his great Work is only fit for those who are well advanced in anatomical Studies.

But these sharp and ill-natured Censures have not had more Influence upon the Fate of VESALIUS's Works, than a gentle Breeze of Wind would have upon Mount Caucasus, or Athos: For his Works ever have been, and, for ought I know, ever will be, esteemed, so long as Anatomy and Physic are thought necessary to the Good and Welfare of Mankind; and that is so long as human Nature endures\*.

As for the Discoveries with which VESALIUS, by his indefatigable Labour and Industry, enriched Anatomy; if I was to enumerate them all, I should not only find the Task difficult in itself, but inconsistent with my present Design: However, not to pass them over entirely, he maintained, that “ The Penis was connected, at the Union of the *Ossa Pubis*, by a certain small Ligament.” This Ligament was delineated by CASTERIUS; and COWPER described and delineated it, under the Name of *LIGAMENTUM PENIS*

\* His Work, *De Humani Corporis Fabrica*, was printed Basil. 1543, Folio; *ibid.* 1555, *ibid.* 1563; Venet. 1568, Folio Min. *ibid.* 1604, Folio. His *Anatomia* was printed Francof. 1604, 1632, Quarto; Lugd. 1552, Duodecimo. His *Epincm. de Humani Corporis Fabrica Librorum* was printed Basil. 1543, Folio; Colon. Agripp. 1600; Paris. 1560, Octavo; Wirtemberg. 1582, Octavo; Londini 1642, Folio. *De Modo propinandi Radicis Chinæ Decoctum*, was printed Basil. 1546, Folio; Lugd. 1547, Decimosexto. His *Examen Anatomicarum Observationum Gabrielis Fallopii*, was printed Venet. 1564, Quarto: The last Edition was *Vesalii Opera Omnia*, Lugdun. Batav. 1725, Folio. See VANDER LINDEN's *De Scriptis Medicis*, and DOUGLAS's *Bibliotheca Anatomicæ Specimen*.



**SUSPENSORIUM.** We are also indebted to **VESALIUS** for the first Delineation of the **AUDITUS OSSA**, or Bones appropriated to Hearing.

He first discovered, that the Optic Nerve was not inserted directly in the Center of the Eye, but a little to one Side. He likewise maintained, that the **Ligamentum Teres Femoris** was not inserted into the Middle of the Head of the Femur, but rather into the Side of it.

I do not pretend to give the Life of **VESALIUS**; for that would require a Volume by itself: My Design is only to shew the State of Anatomy, when he appeared; which, I hope, may be sufficiently known from the preceding Hints.

**CAROLUS STEPHANUS** was a Physician, and Member of the Faculty at Paris; who, by the Assistance of **RIVERIUS**, made such Advances in Anatomy, as to acquire Credit enough to introduce **GALEN**'s Doctrine, which was unknown to the Age in which he lived. He also enriched Anatomy with some Discoveries; such as the **MEMBRANA APOPHYSIS** within the Liver, at the Origin of the Vena Cava; lest the Blood, elaborated there, should regurgitate.

He first maintained, that the Oesophagus and great Artery descended thro' different Apertures, tho' they lay very near to one another; which was quite the contrary to what **GALEN** asserted: And says, that the **Membrana Carnosa** is visible in melted Fat. For if Fat be melted before the Fire, you will observe a thick Membrane remaining. He accurately described the **Septum Scroti**, first observed by **MASSA**, and gives it the Names of **DIAPHRAGMA** and **SEPTUM**.

His Works under this Title, *De Dissectione Partium Corporis humani Libri tres, una cum Figuris, & Incisionum declarationibus a Stephano Riverio Chirurgo*

## xcviii An Historical Compendium.

*rurgo Compositis*, were printed Paris. 1545, Folio; and, in French, Paris 1546, Folio.

This, in general, is to be remarked, with regard to his Plates, that they are imperfect.

JACOBUS SYLVIVS was born at Amiens in Frenu, in the Year 1478; and was afterwards the Pupil of TAGAULITUS. He was a great Admirer of GALEN, and an inveterate Enemy to VESALIUS. Anatomy has been enriched with many of his Discoveries; particularly, he was the first who discovered those Valves that he calls Epiphyfes, or membranous Epiphyfes, in the Mouths of the Vena Azygos, the jugular, brachial, and crural Veins; as also at the Trunk of the Vena Cava, which arises from the Liver.

FABRICIUS AB AQUAPENDENTE unreasonably claims the Glory of this Discovery; but he only described them more accurately; and, from their Use and Structure, gave them the Name of Valves, which they retain to this Day.

He was also the first who observed the Musculus Femoris Quadratus, and ranked it among the Musculi Quadrigeimini, as he calls them.

He accurately describes the Origin of that Muscle in the Thigh called Musculus Rectus; and maintained, that the Tendons of the Musculus Plantaris and Palmaris were wanting in some Subjects.

But what is most surprising, is, his receding from his Master GALEN, in assigning the Origin of the Musculus Rectus Abdominis.

He mentions the large musculous Substance in the Sole of the Foot, that runs out to the Sides of the Toes; and takes Notice of the Musculi Pyramidales arising from the Os Pubis, and calls them Musculi Succenturiati: And, indeed, he may deservedly be said to be the first Discoverer of them.

He

He also takes Notice of the Glands at the first Division of the Aspera Arteria; as also of two Glands at the Root of the Larynx; and of the glandular Substance of the Pylorus\*.

MICHAEL SERVETUS was a Physician, and Native of Spain; a Man of an uncommon Genius. Happy had it been for him, if he had confined his Researches within the Bounds of Physic and Philosophy! But, unluckily, he went beyond his Sphere, and plunged himself into the deepest and most abstruse Points of Theology: For he published a Piece against the mysterious Doctrine of the Trinity, and that, too, at a very unlucky Juncture; I mean the Dawn of the Reformation.

Upon this, CALVIN, the great Champion of that Cause, used his Interest to do him all the Injury he could. And as true Christian Zeal had, in those Days, degenerated into a most hellish and execrable Spirit of Persecution, he found it no hard Task to get him condemned to the Flames; and the Sentence was, accordingly, put in Execution at Geneva, in the Year 1553.

His seven Books, *De Trinitatis Erroribus*, were printed at Basil, 1531; and his *Christianismi Restitutio* was printed at Basil, 1533. Tho' these Pieces made their Author fall an unfortunate Victim to a Spirit of Persecution then prevailing; yet, as a Physician, they will perpetuate his Name to all succeeding Ages: Since, in the fifth Book of the former of these Works, which treats of the Holy Spirit, those Passages were found, that al-

\* His *Opera Medica*, &c. were printed Colon Allobrog. 1630, Folio. His *Depulsio Vesani cujusdam*, &c. was printed Paris. 1561, Octavo. His Piece, *De Mensibus Mulierum*, Venet. 1556, Octavo; Basil. 1556. His Piece intituled, *Ordo, & Ratio Ordinis in Legendis Hippocratis & Galeni Libris*, Paris. 1561, Octavo.

## c An Historical Compendium.

most amount to a Demonstration that he was better acquainted with the Doctrine of the Circulation of the Blood, than any preceding Author.

“ There are, says he, in the human Body Spirits of three different Kinds; the natural, animal, and vital; which are really not three, but two, distinct Spirits. The vital is that which is communicated, by Anastomoses, from the Arteries to the Veins; in which it is called natural: The Blood, therefore, is first; whose Seat is in the Liver and Veins. The vital Spirit is second; whose Seat is in the Heart and Arteries. The animal Spirit is third; which is like a Ray of Light, and has its Seat in the Brain and Nerves.”

Now to understand how the Blood is the Life, he says, “ We must first understand the substantial Generation of the vital Spirit, which is compounded of, and nourished by, inspired Air and the subtilest Part of the Blood. The vital Spirit has its Original in the left Ventricle of the Heart, by the Assistance of the Lungs, which chiefly contribute to its Generation. It is a subtil Spirit wrought by the Force of Heat, of a florid Colour, having the Power of Fire; so that it is a Sort of shining Vapour, made of the purer Part of the Blood, containing within, in itself, the Substance of Water, Air, and Fire. It is made in the Lungs by the Mixture of inspired Air with that elaborated subtil Blood which the right Ventricle of the Heart communicates to the left. Now that this Communication is not made thro’ the Septum of the Heart, as is commonly believed; but the subtil Blood is very artificially agitated by a long Passage thro’ the Lungs, from the right Ventricle of the Heart, and is prepared, made florid by the Lungs, and transfused out of the

“ arte-

“ arterious Vein into the venous Artery; and, at  
 “ last, in the venous Artery itself; it is mixed  
 “ with the inspired Air, and, by Expiration,  
 “ purged from its Dregs: And thus, at length,  
 “ the whole Mixture is attracted, by the Diaſtole  
 “ of the Heart, into the left Ventricle, being now  
 “ a fit Substance out of which to form the vital  
 “ Spirit.

“ Now that this Communication and Prepa-  
 “ ration is made by the Lungs, is evident, from  
 “ the various Conjunction and Communication  
 “ of the arterious Vein with the venous Artery in  
 “ the Lungs: The remarkable Largeness of the  
 “ arterious Vein likewise confirms it, since it  
 “ would never have been made of that Form and  
 “ Bulk; nor would it have emitted so great a  
 “ Quantity of very pure Blood out of the Heart  
 “ into the Lungs, if it had been only for their  
 “ Nourishment; nor would the Heart have been  
 “ this way serviceable to the Lungs, since the  
 “ Fœtus in the Womb is otherwise nourished, by  
 “ reason of the Closeness of the Membranes of  
 “ the Heart, which are never opened till the  
 “ Birth of the Child, as GALEN teaches: So that  
 “ the whole Mixture of Fire and Blood is made  
 “ in the Lungs, where there is a Transfusion out  
 “ of the arterious Vein into the venous Artery,  
 “ which GALEN took no Notice of.”

Afterwards he says, that “ This vital Spirit is  
 “ transmitted, from the left Ventricle of the  
 “ Heart, into the Arteries of the whole Body;  
 “ so that the more subtil Parts get upwards, where  
 “ they are yet more refined, especially in the  
 “ Plexus Retiformis, which lies in the Base of the  
 “ Brain; where, from vital, it begins to become  
 “ animal, and approaches the proper Nature of  
 “ the rational Soul.”

## cii An Historical Compendium.

The Circulation of the Blood, is a Discovery of such Importance, that every one, who gives the remotest Hints of it, has some Party to take him by the Hand, and canonize him as the first Discoverer.

Thus HIPPOCRATES, GALEN, and a great many more, have had their respective Champions, in this Particular, who have pronounced boldly, either one Way or the other, just as Whim and Caprice directed them. But as such a Turn of Mind is a Disgrace to Philosophy, and a Reproach to human Nature, whose Glory and Dignity consist in shaking off Prejudice, and adhering inviolably to Truth, wherever it can be found; so we will not absolutely pronounce, that SERVETUS knew the Doctrine of the Blood's Circulation: But it is certain, that the first Step, made to this noble and useful Discovery, was, the finding that the whole Mass of Blood passes thro' the Lungs by the pulmonary Artery and Vein.

Now that SERVETUS had a pretty distinct Idea of this Matter, is sufficiently plain, from the foregoing Passages; but he talked in too vague and indetermined a Manner, to be esteemed a full and uncontested Discoverer.

REALDUS COLUMBUS was a Native of Cremona. He flourished about the Year 1544, and was intimate with VESALIUS, whose public Lectures he had frequently an Opportunity of hearing. He is charged by some with want of Gratitude to VESALIUS, from whom he is said to have stolen every Thing that is valuable in his own Works: But others maintain, that he had a clearer Idea of the Parts than VESALIUS, and described them more accurately; and it is certain, that his Latin is very pure.

He was the first who wrote distinctly and accurately about the Caruncles in the Vagina Muliebris;

bris; also the first who mentions the Duplicature of the Peritonæum; and affirmed, that the Pleura was every-where double. He assumes to himself the Discovery of the Tunica Innominata of the Eye, and accuses all his Predecessors of Ignorance in that Point. But DOUGLAS thinks, that the Tunic of the Eye which GALEN describes under the Name of Tunica Sexta, is the very same he means.

He also boasts of his having first discovered the third Bone subservient to Hearing; and affirms of VESALIUS, that he not only described, but publicly dissected, the Tongue, Larynx, and Eyes, of Oxen, instead of those of Men; and that he himself was an Eye-witness of the Imposture.

AS GALEN and VESALIUS exceeded in the Number of the Muscles of the Eye, so COLUMBUS is as remarkably deficient in that Point; since he determines, that there are only five.

The Use by him ascribed to the Lungs deserves to be taken Notice of: For he thinks, that they were bestowed on Animals for this Purpose; that the Blood and vital Spirit might be prepared and generated in them. For he thinks, that the Blood, being attenuated, by Elaboration, in the right Sinus of the Heart, is carried thro' the Vena Arteriosa to the Lungs; where, by their continual Motion, it is agitated, still farther attenuated, and mixed with that Air which is drawn in thro' the Nostrils and Mouth, and carried thro' the Rami of the Aspera Arteria to the Whole of the Lungs; which Air is itself prepared by this Collision: So that the Blood and Air, being thus mixed, are received into the Rami of the Arteria Vena, and at last carried, thro' the Trunk itself, to the left Ventricle of the Heart; from which they are carried thro' the Aorta, in every Direction, to all Parts of the Body.

## civ An Historical Compendium.

Since this Opinion is largely insisted on by MICHAEL SERVETUS, we have Reason to suspect, that COLUMBUS borrowed it from him. This also GALEN had advanced long before SERVETUS, when he says, that, when the Thorax is contracted, the venous Arteries, which are in the Lungs, being on all Hands pent up and compressed, quickly throw out the Spirit contained in them; but that they receive some Portion of Blood from the Vena Arteriosa by minute and invisible Orifices\*.

JOHANNES VALVERDA was a Physician, Native of Spain, and Pupil of REALDUS COLUMBUS. He is said to have carried the Knowledge of Anatomy from Italy by Spain, and published the Tables of VESALIUS, with their Descriptions, somewhat enlarged in the Spanish Language, and added four new Figures to them: The first of which exhibits the Direction and Progress of the Fibres which compose those Muscles that cover the fore Part of the Body; the second represents a Woman big with Child; the third and fourth give us a Prospect of the cutaneous Veins, scattered up and down the anterior and posterior Parts of the Body. But he is an Author of too small Note, to be insisted on at greater Length; since the greatest Character we find given him is, that he was rather to be commended for his Industry in propagating Anatomy, than for his writing well upon any Part of it.

GABRIEL FALLOPIUS was born at Modena in Italy, in the Year 1490. His Skill in Physic and Anatomy has made him universally admired. DOUGLAS, in his *Bibliographia Anatomia*, has

---

\* His Works were printed under the Title of, *Realdi Columbi in Alma Gymnesia, Patavino Anatomici Celeberrimi, de re Anatomica Libri Quindécim*, Venet. 1559, Folio; Paris. 1572, Octavo; Lugd. Bat. 1667, Octavo.



beautifully drawn his Character, when he says, that he was “ *In docendo maxime Methodicus, in Medendo felicissimus, in secundo expeditissimus;* ” “ Most judicious and methodical in his Method of teaching, most successful in his Practice, and most expeditious in his Dissections.”

He died in 1563, in the 73d Year of his Age, after having illustrated Anatomy, and enriched it with several Things unknown to former Ages.

He affirms, in particular, that the Musculi Pyramidales were first discovered by him; and he is of Opinion, that the Bladder is compressed by them: But this was observed, before him, by GALEN and JACOBUS SYLVIVS.

He boasts of his being the first who solved the perplexing Difficulty of ORIBASIUS, or rather of GALEN, concerning the Motion of the superior Eye-lid, after the Musculus Orbicularis is cut off. For he affirms, that, in the Year 1753, he discovered the Muscle that raises the superior Eye-lids. But GALEN himself solves this Difficulty, at a Time when he was become venerable for his Age and Experience, that is, when he digested the *Commentaries de Locis male affectis*; as will evidently appear to any one who reads them. Besides, AVICENNA clearly describes this Muscle\*. The same Muscle is likewise accurately described by REALDUS COLUMBUS, in his anatomical Works, Anno 1559.

Tho’ he is esteemed the Discoverer of that seminal Duct which he calls the TUBA UTERI, whose Extremity, in which there is a large Aperture, is lacerated and fringed, as it were, like the Edges of old worked linen Cloth; yet it is excel-

---

\* Lib. 1. Sum. 2. De Musculis, Cap. 5.

## cvi An Historical Compendium.

lently described by HEROPHILUS and RUFUS EPHESIUS, who lived long before him.

By the true Neck of the Womb, he means all that Part from its internal Orifice till it begins to enlarge itself, and grow wider: But the Whole of that Passage into which the Penis enters, is by him called SINUS and PUDENDUM MULIEBRE\*.

BARTHOLOMÆUS EUSTACHIUS was a Native of Italy, and a Man of very extensive Learning. His Tables, it is to be presumed, have made his Character, as an Anatomist, sufficiently known where Learning is countenanced, or even heard of. He enriched Anatomy with several Discoveries; for he first discovered the Glands that lie upon the Kidneys.

He finds Fault with VESALIUS for describing, dissecting, and delineating, the Kidney of a Dog, instead of that of a Man, without so much as taking Notice of the Difference.

He maintained, that the Duct of the renal Veins is oblique, and not transverse, as is delineated by VESALIUS; and exhibited, in a most beautiful Figure, the Canaliculi Urinarii, which he compares to very small Hairs; but which were before described by NICOLAUS MASSA.

In his Examination of the Bones he says, the true Structure of the visory Nerve was first discovered by himself; and adds, that, when it is immersed in Water, it is expanded into a large Membrane, like a very thin linen Cloth.

---

\* His *Observationes Anatomicæ* were printed Venet. 1561, Octavo; Paris. 1562, Octavo; Helmst. 1588, Octavo. His *Expositio in Librum Galeni de Ossibus*, was printed Venet. 1570. His *Lectiones de Partibus similaribus humani Corporis*, were published Norimberg. 1575, Folio. His *Compendium de Anatome humani Corporis*, appeared Patav. 1585, Octavo; Venet. 1571. His *Opera Omnia*, Venet. 1584, Folio; Francof. 1600, Folio.

Concerning the third Bone of the internal Ear, called STAPES, he has these Words: " I am conscious to myself, that, without either Instruction or Information from any one, I knew that Bone long before they wrote; and that I shewed it to many in Rome, and caused it to be engraved on Copper."

He was the first who gave an accurate Description of the thoracic Duct, or the Passage by which the Chyle is conveyed to the Heart, which he says, in Horses, resembles a white Vein, and has a semi-circular Mouth, opening into the internal jugular Vein.

He was the first who observed the Valve at the Orifice of the Vena Coronalis in the Heart; and boasts of having first discovered, and exactly described, that Valve which is by some called VALVULA NOBILIS, in the Vena Cava, near the right Auricle of the Heart; tho' JACOBUS SYLVIVS seems to have observed it before him\*.

VOLCHERUS COITER was born at Groningen, in the Year 1534, and, in Process of Time, acquired a very great Character, as a Physician, Surgeon, and Anatomist. In his Introduction to Anatomy, Chap. 6. he gives good Advice to such as are desirous of making quick and regular Advances in their anatomical Studies.

Anatomy is considerably indebted to this Author for his Labour and Industry; for he clearly specifies the first Origin of the Bones, accounts

\* In his Treatise, *De Renibus*, he makes mention of the Glands of the Larynx. His *Opuscula Anatomica* were printed Venet. 1563, Quarto; his *Libellus de Dentibus*, Venet. 1563, Quarto; his *Episiola Nuncupatoria*, Romæ, 1562; his *Opuscula cum Annotationibus*, Venet. 1574, Quarto; Lugd. Batav. 1707, Octavo; and his *Tabulæ Anatomica* were published, by JO. MARIA LANCISI, Romæ 1714, Folio; and afterwards Amstelod. 1722, Folio; then Romæ 1728, Folio; and lately by ALBINUS.

His Notes upon EROTIAN were published Venet. 1566.

for their Growth, and points out the Difference between those of Infants and Adults : For he used to prepare Skeletons of Children, compare their Bones with those of Adults, and demonstrate the Difference between them to his Pupils in Bologna ; where, in his own House, he exhibited an abortive Fœtus, as long as a Finger, and furnished with all the Parts of a human Body. He also makes mention of another that he saw at Bologna, in the House of Dr. ARANTIUS.

In his *Traëtatus de Auditus Instrumento*, he has these Words : “ What FALLOPIUS called the “ Tympanum, he chiefly took from the Ears of “ Brutes, and such Animals as chew the Cud ; “ for these have this Passage formed like a certain “ Species of Sea Shell, or a Turkish Drum ; “ whereas, in Man, this Passage is vastly different “ from the Shape of a Drum.”

For this Reason he thinks, that this Passage, or the second Cavity, receives its Denomination of Tympanum, rather from its Use, than its Form. He maintains, that there are two of these Cavities : “ For, says he, immediately behind the “ Myringa (by which he meant the Tympanum), “ in the upper and fore Parts, appears a Cavity, “ which is at first narrow, but afterwards, dilating “ itself, is stretched backwards towards the upper “ Parts ; and this Part is spongy and fungous, “ and seems to have a Communication with the “ internal Space of the Processus Mamillaris.”

According to him, two of the Officula Auditus, that is, the two largest, are full of small Holes, which are filled with a medullary Substance ; but the third contains none, on Account of its exceeding Smalness.

He says, that there are two Muscles of the internal Ear, assigned by some, but he does not describe them.

To

To the Muscles belonging to the Face he adds some others, which, by later Authors, are called the *MUSCULI CORRUGATORES*; but, from their principal Office, should rather be styled *MUSCULI SUPERCILIORUM DEPRESSORES*; which he first discovered, and accurately described, but gave them no Name. He adds, “ You will also observe, under the internal Skin of the Lips and that of the Root of the Tongue, many fleshy Glands, under which are found Fibres rising upwards from their Sides, in an oblique Direction; and these, to me, seem to draw the under Lip inwards\*.”

*JULIUS CÆSAR ARANTIUS*, born at Bologna, was the Pupil of *VESALIUS*, as also of his Uncle *BARTHOLOMÆUS MAGUS*, who taught him the Elements of Anatomy in the Year 1548. His Piece intituled, *De humano Fœtu Opusculum*, was printed Venet. 1571, Basil. 1579, Octavo; Venet. 1587, Quarto. To this Edition he joined a Preface, and a Book of anatomical Observations, printed Venet. 1595.

In the first Chapter of the last Edition of this Book he describes the true and genuine Substance of the Uterus; asserting, that it is fungous, and bears a Resemblance to a Sponge: That it is not single, but divisible into many Laminæ, like certain Fungi that grow under Trees; and that it is perforated with Holes, like a Sponge, or Pumice Stone.

In the third Chapter he not only accurately describes the Vessels of the Uterus, but also main-

---

\* His Piece intituled, *De Cartilaginibus Tabulæ*, was printed Bonon. 1566, Folio; his *Externarum, atque internarum, principalium humani Corporis, Tabulæ*, &c. Norimberg. 1573, Folio; *Lavarii*, 1653, Folio; his *Lectiões Gabrielis Fallopii, de Partibus similaribus humani Corporis, ex diversis Exemplaribus, Summa cum diligentia collectæ*, &c. were printed Norimberg. 1575, Folio.

tains, that its Arteries are continued to the Veins; which he also takes to be the Case with all the Arteries and Veins in the human Body; which is the same as if, with later Authors, he had maintained, that the Veins were no more than Arteries returning to the Heart.

The spermatic and hypogastric Arteries, which he calls the descending and ascending ones, not only unite, and are continued together; but the Vessels of the right Part of the Uterus are intermixed with those of the left.

And in the fourth Chapter he treats largely and accurately of the Coalition of the Vessels in the Heart of a Fœtus. “A few Days, says he, “after their Birth, there is a Coalition of this “Foramen; tho’, even in older Subjects, some “remaining Marks of that Agglutination are always retained.”

He also makes mention of another Coalition in the Liver, that of the Vena Portæ, with the Vena Cava, which is now universally called Ductus VENOSUS.

That white and rising Part of the Basis of the Ventricles of the Brain which is stretched forwards, on both Sides, in a longitudinal Direction, to the Forehead, he calls PEDES HIPPOCAMPI.

He says, that the Muscles of the Eye arise from the Os Sphenoïdes, hard by the Foramen, thro’ which the optic Nerve passes; but that one of the oblique Muscles, or that called MUSCULUS BREVIS, arises from a certain Suture, or Cleft, that divides the Bones of the Maxilla Superior from the Ossa Mali.

He also asserts, that the Musculus Palpebræ Superioris, destined for opening the Eye, and rising also from the Os Sphenoïdes, was known to him in the Year 1548; first observed the interior Chink of the Larynx, accurately described it, and

ap-

appositely enough compared it to the Clefs in musical Wind Instruments.

Tho' he does not openly acknowledge the Circulation of the Blood, yet he largely specifies all the Arguments that are calculated for destroying the Hypothesis of the Antients concerning a Transudation thro' the Septum, or Partition that divides the Ventracles of the Heart.

He first observed, that the Duct of the Artery of the Spleen was oblique, and twisted in Form of a Snake; was the first who asserted that the middle Substance of the Urethra, or of the Canal common to the Urine and Semen, was of the same Structure with the Penis itself, and capable of being distended and becoming flaccid; and first took Notice of an orbicular Muscle, surrounding, on all Sides, the Sinus Muliebris: But this Discovery was owing to JACOBUS CARPUS, who had before described the whole Neck of the Uterus as a muscular Substance.

According to him, the Musculi Recti of the Abdomen arise, with a musculous Origin, from the Pubes, when their Covering (he means their Musculi Pyramidales) are wanting; and maintains, that the Portion of the Musculus Biceps, which, according to VESALIUS, arises from the Process of the Acromion, and is inserted into the Humerus, is the eighth Muscle of the Humerus, which was afterwards, by RIOLAN, called CORACO-BRACHIÆUS. But it is, without Reason, by some called NONUS HUMERI PLACENTINI; since it is, in Reality, the Discovery of ARANTIUS.

He likewise discovered the Indicator, or Indicis Extensor Proprius, which had remained unobserved before him; and maintained, that the second Muscle of the Fingers, by which he means what is now called the Flexor Perforans, was the

In-

Instrument of bending all the Inter-nodes, and not of the third Joint only, as his Predecessors had maintained.

He assumes to himself the Discovery of the Musculus Femur Circumagens, which he calls the twelfth: He likewise observes, that a Portion of the Musculus Femoris Primus, that is, of the Glutæus Maximus, becomes a membranous Tendon, which, joining wth another Tendon, arising from the sixth Muscle of the Tibia, or Fascialis, is strongly and laterally inserted into the Appendix Tibiæ. By means of this Communication, he accounts for the Pains of the Hips reaching to the Knee.

In his *Observat. Anatom.* Cap. 16. he has these Words, concerning the Substance of the Testicles: “ Perfect Semen is carried, as it were, from num-  
“ berless small Roots of a Plant, variously dis-  
“ perfed thro’ the Substance of the Testicles,  
“ which Roots appear wrapped up and curled like  
“ the Tendrils of Vines, and resemble white curled  
“ Hair.”

CONSTANTIUS VAROLIUS was a Native of Bologna; an accurate Philosopher, an expert Surgeon, and a skilful Anatomist. He is said to be the first who discovered the Valve of the Colon, and elegantly described it, in the following Words: “ Where the Ilium is joined to the Colon, there  
“ rises, in its inner Part, a certain Membrane,  
“ being the last Boundary of the Ilium, which  
“ reaches so far, and which I, its first Discoverer,  
“ call the OPERCULUM ILII.” And, a little after, he makes mention of the “ Appendix of  
“ the Colon as being an oblong Sack, imperfo-  
“ rated at one of its Extremities, which is called  
“ the INTESTINUM CÆCUM.” He first divided the Brain into three Parts, by adding the Beginning of the spinal Marrow, whilst yet contained within



within the Skull, and giving Birth, as it were, to the Nerves, whose Origin was formerly thought to be the Brain.

The Optic Nerve, according to him, arises from the posterior Part of the spinal Marrow, and not from the Base of the Brain, in its anterior Part, as GALEN, and others, maintained.

The transverse Process of the Brain is called PONS VAROLII, from VAROLIUS, its first Discoverer. He first discovered the Glands in the Plexus Choroïdes.

SALOMON ALBERTUS was Professor of Physic at Wirtemberg, and published a Book intituled, *Historia Plerarumque Corporis humani partium, in Usum Tyronum*, Wittebergæ, 1583, 1602, 1630, Octavo.

The Discovery of the Valve of the Colon, commonly called VALVULA BAUHINI, is justly ascribed to him: For he affirms, that he first discovered it in a Beaver, and then in a Man.

His three Orations, *De Disciplina Anatomica*, were printed Nirembergæ, 1585, Octavo; and his *Observationes Anatomicae*, Wittebergæ, 1620, Octavo.

ARCHANGELUS PICCOLHOMINUS was a Native of Ferrara, and Citizen of Rome. He was born in the Year 1526, but, in RIOLAN's Opinion, he was rather a Philosopher than an Anatomist, since his anatomical Prelections are interspersed with physiological Disquisitions, and fine-spun Controversies, quite foreign to Anatomy. But that he laboured with Success, in this Branch of Learning, is sufficiently evident, from the Improvements and Discoveries he has made in Anatomy\*.

---

\* His *Anatomia, sive de resolutione Corporis humani, Libri Quatuor*, &c. was printed Patav. 1573, Octavo; Francof. 1591, Octavo.

## cxiv An Historical Compendium.

He was the first who divided the Substance of the Brain into cineritious and medullary; for he calls that concretion or whitish livid Body, that first appears, the Brain itself: But he calls that solid white Body, which is wrapped up in it, the Medulla, or Marrow which he distinguishes into three Kinds; the MEDULLA GLOBOSA, MEDULLA OBLONGATA CAUDICIS INSTAR, and MEDULLA SPINALIS.

He maintains, that all the Nerves have their Origin from the Medulla Oblongata; and was the first who called the Processus Mammillares Nervi ODORATORII, or the Nerves by which the Sensation of Smelling is produced.

He first discovered that wonderful Contrivance of Nature at the Beginning of the Intestinum Cæcum; that is, three Valves, like little Doors, opening downwards; and asserted, that they were designed to prevent the Return of the Fæces.

He also first delineated the Anastomosis of the Vena Portæ and the Vena Cava within the Liver, after it had been described by JACOBUS CARPUS; ascribed Prostatae to Women, as GALEN had done before him; was the first who described the particular Membrane of the Fat which RIOLAN afterwards called MEMBRANA ADIPOSA; asserts, that the Peritonæum is every where double, and consists of two Laminæ; and first took Notice of, and described, that Line of the Abdomen which is now called LINEA ALBA.

In his Opinion, there was only one continued Duct that reached from the Mouth to the Anus; and affirms, that the internal Tunic of the Intestines is three Times as long as the external one; and that it is corrugated, and formed into Wrinkles, that the Chyle, by that Means, remaining longer in them, might be the more commodiously extracted by the mesenteric Veins.

He

He describes the membranous Canals, or Tubes with a fleshy Covering, thro' which the Urine is strained, better than *CARPUS* or *MASSA*.

The Reason he assigns why the left spermatic Vein does not arise from the emulgent, is precisely the same which is embraced by the Moderns.

He calls the Hymen, *CLAUSTRUM VIRGINITATIS*; and assigns Names to all the Muscles, from the Uses and End for which Nature designed them. Thus he named the *MUSCULI OCULARII*, or *VISORII*; *MASTICATORII*; *LOCUTORII*; *RESPIRATORII*; *AMPLEXATORII*; *SCAPULARII*; *HUMERARII*; *CUBITARII*; *APPREHENSORII*, or *MANUM MOVENTES*; *AMBULATORII*, or *PROGRESSORII*; *FERNERALES*; *TIBIALES*, &c.

He called the frontal Muscles, *MUSCULI PANTHEMATIUM*, or *MUSCULI ANIMI AFFECTUUM SIGNIFICATIVI*\*.

*CASPARUS BAUHINUS* was born at Basil, in the Year 1560, and was universally esteemed to be a skilful Anatomist, and curious Botanist: But *RIO-LAN* speaks of him as ignorant, injudicious, and presumptuous. He says, that, in the Year 1579, he observed the Valve in the Beginning of the Ilium, or Colon, before he read any Author who made mention of it. But it is certain, that *VAROLIUS*, and a great many others, described it, very accurately, many Years before.

He took Notice of the natural Narrowness of the Intestinum Colon in the right Side; and for this Reason colic Pains not only arise most frequently, but rack most violently, in that Part: For that narrow Passage is easily obstructed by the

\* His *Anatomicæ Prelectiones* were printed Romæ 1586, Folio; and his *Commentarii in Librum Galeni de Humoribus*, Paris. 1556, Octavo.

Excrements, which are long retained there, and indurated\*.

JOHANNES POSTHIUS was born, in the Year 1537, in Germersheim, a Town of the lower Palatinate upon the Rhine; and died, in the sixtieth Year of his Age, in the Year 1597. He seems to be very dextrous at dissecting the Muscles, which is sufficiently proved, by some Discoveries he has made.

He maintains, that there are four Muscles which draw the Lips inwards to the Teeth; two in the inferior, and two in the internal Part; ascribes six Muscles to the Penis; and affirms, that there is only one Muscle between the Cartilages of the Ribs, and not two, as in the intercostal Spaces.

He says, that the fourth Muscle of the Maxilla Inferior does not arise from the Styloid, but from the mammillary Process; and was the first who asserted, that the tendinous Part of this Muscle adhered to the Os Hyoides. He also asserts, that the Processus Mammillares are not the Organs of Smelling; and advises, to dissect the Muscles as much as possible, in such a Manner, as to preserve their Origins and Insertions entire; because, by this means, their Uses may be most commodiously discovered†.

\* His Piece intituled, *De Partibus humani Corporis externis Liber*, was printed Basil. 1588; his *Anatomes Liber Secundus*, ibid. 1591, Octavo; his *Anatomica Corporis Virilis & Muliebris Historia*, Lugd. Bat. 1597, 1609, Octavo; his *De Corporis humani Fabrica*, Lib. 4to, &c. Basil. 1600, Octavo; his *Theatrum Anatomicum*, Francof. 1605, Octavo; ibid. 1621, Quarto; his *Institutiones Anatomicae*, &c. Basil. 1603, 1609, Octavo; 1640, Quarto; Francof. 1616, Octavo; Oppenheimii, 1614, Octavo; 1629, Octavo; his *Epistola Anatomica Curiosa*, Lips. & Franc. 1673, Quarto.

† His *Observationes Anatomicae* were printed Francof. 1590, 1593, Octavo: his *Mantissa Anatomica* was printed Hafniae 1661, Octavo.

## An Historical Compendium. cxvii

ANDREAS CÆSALPINUS, born at Arezo in Italy, was a strong Champion for the Peripatetic Doctrine, in Opposition to GALEN, who was, at that Time, revered as an Oracle. Hence it was, that the Writings of CÆSALPINUS, tho' very valuable in themselves, were neglected; and those Passages which he casually wrote, concerning the Circulation of the Blood, either not adverted to, or not understood, by any, till HARVEY published his Treatise on the Subject.

CÆSALPINUS affirms, with ARISTOTLE, that the Heart is not only the Source and Origin of the Arteries and Veins, but also of the Nerves.

In Quest. 4. where he proves, that, in Respiration, no external Air can have Access to the Heart; he has these Words: " For the Membranes are so fitted and adapted to the Mouths of the Vessels, that, when the Heart is dilated, they are opened; but, when it is contracted, they are shut."

Here he also clearly and fully explains the Contraction and Dilatation of the Heart.

" Some of the Vessels, continues he, which terminate in the Heart, send their Contents into it; such as the Vena Cava, into the right Ventricle, and the venous Artery into the Left: Some of them, on the other Hand, draw their Contents from it; as the Arteria Aorta from the left Ventricle, and the arterious Vein from the right; but they all have Membranes so fitted and adapted to them, that the Mouths of the intromitting Vessels will not admit of a Return, and the eliminating Vessels will not admit of an Intromission. It happens, that, when the Heart is contracting, the Arteries are dilated; and, when it is dilating itself, they are contracted."

## cxviii An Historical Compendium.

For when the Heart is dilating, it shuts the Orifices of the eliminating Vessels, so that nothing can, at that Time, flow from the Heart into the Arteries; and, when it is contracting, its Contents must flow into the Vessels, because the Membranes are then opened.

He maintains, that the Pulsation of the Heart and Arteries proceeds from an Effervescence of Humours in the Heart; and he treats largely of the Pulse.

Soon after, he has these Words: “ The Lungs, therefore, drawing the hot Blood from the right Ventricle of the Heart, by a Vein resembling an Artery, and by Anastomosis returning it to the venous Artery that goes to the left Ventricle of the Heart; the fresh Air is, in the mean Time, transmitted thro’ the Canals of the Aspera Arteria.”

REALDUS COLUMBUS had advanced the same before him.

“ The several Phænomena, appearing upon the Dissection of a Subject, correspond excellently with this Circulation of the Blood, from the right Ventricle of the Heart, thro’ the Lungs to the left Ventricle.”

And, a little after, he, with a great deal of Learning, proves, that the Antients had no manner of Reason for giving the Names of ARTERIA VENOSA, and VENA ARTERIOSA, to the Vessels that bear these Names; since, in his Opinion, one of them was an Artery, and the other a Vein.

In his fifth Question, where he shews that the Heat of the Heart is the Principle of Motion in Respiration, he has these Words: “ The same hot Blood which, by dilating the Heart, causes the Pulse; is also, by dilating the Lungs, the Cause of Respiration.”

The Lungs, then, being enlarged, the external Air must necessarily rush into the Aspera Arteria; which Inspiration is, for that very Reason, called Refrigeration; and a Diminution of Bulk happens, just as in boiling Liquors, when cold ones are poured into them: But when the Lungs collapse, the Air must necessarily be returned; which is called Expiration.

In his sixth Question he endeavours to prove, that no Part, in which there is not Blood, can be capable of Sensation. But tho', in his Opinion, there can be no Sensation without a Nerve; yet it is not the Nerve that feels, but the Flesh, or Part, in which the Blood is contained.

“ The Contrivance of Nature, says he, in animal Motion, resembles that of Organs, which, by means of the Air, communicated to the Pipes, and by touching sometimes one, and sometimes another Key, produce the various Combinations of Sounds intended by the Organist.”

In the seventeenth Question of his second Book he says, that Suffocation, in a Quinsey, is rather produced by the Repletion of the jugular Veins, than the shutting up the Mouth of the Larynx: For when the Veins of the Neck are so obstructed that the Blood and Spirits cannot ascend, they must necessarily regurgitate to the Heart and Lungs; and the Lungs being filled, and becoming replete by this means, cannot contract and dilate themselves.

In Page 234. he has these Words: “ The Veins become turgid beyond the Ligature, and not betwixt it and the Heart; but it ought to have been otherwise, if the Motion of the Blood and Spirits had been from the Viscera to the several Parts of the Body. For the Passage being obstructed, the progressive Motion of the

“ Blood is stopped, so that the Veins should have  
 “ become turgid betwixt the Ligature and the  
 “ Heart.”

Let us see whether this Difficulty is solved by what ARISTOTLE has said, *Lib. de Somno*, Cap. 3. where he has these Words: “ For that which is  
 “ evaporated, must necessarily be impelled to some  
 “ Part, and then transformed and changed in the  
 “ same Manner with that Arm of the Sea called  
 “ Euripus: For that which is warm in every Ani-  
 “ mal, has a Tendency to fly upwards; but when  
 “ much of it is lodged, at one and the same Time,  
 “ in the upper Parts, it then returns, and is car-  
 “ ried downwards.” Thus far ARISTOTLE.

“ For the understanding of which Passage we  
 “ must know, that the Passages of the Heart are  
 “ so contrived by Nature, that there is an Entry  
 “ from the Vena Cava to the right Ventricle of  
 “ the Heart, from which there is a Passage into  
 “ the Lungs; and that from the Lungs there is  
 “ another Passage into the left Ventricle of the  
 “ Heart, from which, at last, there is a Passage  
 “ into the Arteria Aorta, certain Membranes be-  
 “ ing fitted to the Mouths of the Vessels, to  
 “ hinder the Return of the Fluids: For thus  
 “ there is a perpetual Motion from the Vena  
 “ Cava thro’ the Heart and Lungs into the Ar-  
 “ teria Aorta.

“ When we are awake, the Motion of the na-  
 “ tural Heat is towards the Surface of the Body,  
 “ which is the immediate Instrument of Sensation:  
 “ And since, during Sleep, it is towards the Heart;  
 “ we may suppose, that, in a waking State, many  
 “ Spirits, and much Blood, are conveyed into the  
 “ Arteries, and from thence carried into the  
 “ Nerves; but that, in Sleep, this same Warmth  
 “ returns to the Heart thro’ the Veins, and not  
 “ thro’ the Arteries: For there is a natural Pas-  
 “ sage



“ sage to the Heart thro’ the Vena Cava, but not  
 “ thro’ the Artery. A Confirmation of this may  
 “ be had from the Pulses of the Arteries, which,  
 “ in waking People, are high, vehement, quick,  
 “ frequent, and, in some Degree, vibratory; but  
 “ in Sleep they are low, languid, slow, and loiter-  
 “ ing: For, during Sleep, very little of the na-  
 “ tural Heat goes into the Arteries; and it rushes  
 “ into them with greater Violence when we awake:  
 “ But it is quite otherwise with the Veins; which,  
 “ during Sleep, become turgid, but lessen, and  
 “ become smaller, when we are awake; as will  
 “ appear, by taking a View of those in the Hand,  
 “ in these two different States. For the native  
 “ Heat, during Sleep, passes from the Arteries  
 “ into the Veins by a Communication of Orifices  
 “ called *Anastomoses*, and from thence to the  
 “ Heart. But as the Flux of Blood towards the  
 “ upper Parts, and its Reflux to the lower, after  
 “ the Manner of *EURIPUS*, is manifest, both du-  
 “ ring a State of Sleeping and Watching; so the  
 “ Motion of it, in any Part of the Body, is very  
 “ sensible, when a Ligature is applied, or the Veins  
 “ are obstructed any other Way. For when the  
 “ Passage is intercepted, those Rivulets swell at  
 “ the very Part where they were used to flow ea-  
 “ sily. Perhaps the Blood, on such an Occasion,  
 “ returns to its Source; lest its Motion, being in-  
 “ tercepted, should be quite destroyed.”

Tho’ *CÆSALPINUS* writes, as one would think,  
 very explicitly upon this Matter; yet we will not  
 take upon us to determine, positively, that he  
 knew this Affair distinctly.

We rather think, with *WOTTON*, “ That  
 “ this Notion had only been occasionally and  
 “ slightly treated of by *COLUMBUS* and *CÆSAL-*  
 “ *PINUS*, who themselves, in all Probability, did  
 “ not know the Consequences of what they as-  
 “ ferted;

## cxxii An Historical Compendium.

“ ferted ; and therefore it was never applied to  
“ other Purposes, either to shew the Uses of the  
“ other Viscera, or to explain the Nature of Dis-  
“ eases : Neither, for any Thing that appears at  
“ this Day, had they made such Numbers of Ex-  
“ periments as were necessary to explain their  
“ Doctrine, and to clear it from Opposition. All  
“ this Dr. HARVEY undertook to do, and with  
“ indefatigable Pains traced the visible Veins and  
“ Arteries throughout the Body, in their whole  
“ Progress from and to the Heart, so as to de-  
“ monstrate, even to the most incredulous, not  
“ only that the Blood circulates thro’ the Lungs  
“ and Heart ; but the very Manner how, and  
“ the Time in which, that great Work is per-  
“ formed\*.”

This Author died at Rome in 1603.

HIERONYMUS FABRICIUS AB AQUAPENDENTE, so called from a Town in Tuscany, where he was born, was Pupil to GABRIEL FALLOPIUS, then Professor of Anatomy at Padua, whom he succeeded, in that Province, in the Year 1565 ; and continued in it upwards of fifty Years. He died at Padua in 1619.

In 1574, he first observed the Valves of the Veins, of which, it is said, he was informed by Father PAUL ; but he was not acquainted with their Structure or Uses.

He discovered a small Muscle in the internal Ear, which he appropriates to the Malleus ; and affirms, that the Cuticle consists of two Laminæ. He was also the first who looked upon the carnous Tunic of the Bladder as a Muscle concerned in the Expulsion of the Urine.

---

\* His *Questionum Peripateticorum Libri Quatuor*, *Dæmonum investigatio Peripatetica*, *Questionum Medicarum Libri Duo*, & *de Medicamentorum Facultatibus*, were printed Venet. 1593, Quarto.

## An Historical Compendium. cxxiii

Besides these Particulars, he has many others that deserve Attention; and, upon the Whole, was an accurate Anatomist, and admirable Surgeon\*.

JOHANNES PHILIPPUS INGRASSIAS, a Sicilian by Birth, and Professor at Naples, flourished about the Year 1546. He claims the Discovery of the Stapes, a small Bone of the internal Ear; and is the first who describes the true Structure of the Os Cribrosum†.

ANDREAS LARENTIUS was Professor of Physic, Chancellor of the University of Montpellier, and Physician to HENRY IV. of France; died in the Year 1619.

His anatomical Works are more remarkable for Elegance of Style, than Correctness, with respect to the Subject; for he is said to have made a great many Mistakes, and to have laid Claim to many important Discoveries, which were, however, known to preceding Authors.

His Errors are said, by RIOLAN, to be owing to his trusting to the Reports of others, without examining the Parts himself. His anatomical Works and Figures, notwithstanding, have been in very good Repute||.

\* His Works are, *De Visione, Voce, & Auditu*, Venet. 1600, Folio; *Tractatus de Oculo Visus Organo*, Patav. 1603, Folio; Francof. 1605---1613, Folio; *De Venarum Ostiis*, Patav. 1603, Folio; *De Locutione & ejus Instrumentis*, ibid. 1603, Folio; *De Musculi Artificio, & Ossium Articulationibus*, Vicent. 1614, Quarto; *De Respiratione, & ejus Instrumentis*, Patav. 1615, Quarto; *De Motu locali Animalium*, Patav. 1618, Quarto; *De Gula, Ventriculo, Intestinis Tractatus*, Patav. 1618, Quarto; *Opera Anatomica*, Francof. 1623, Patav. 1625; *Opera Omnia Physiologica & Anatomica*, Lips. 1687, Folio; *Opera Anatomica cum Præfatione Albini*, Lugd. Batav. 1738, Folio.

† His only anatomical Work is, *Commentaria in Galeni Librum de Ossibus*, printed Panor. 1603, Folio; Venet. 1604, Folio.

|| His Works are, *Histor. Anatom. humani Corporis, &c.* Paris. 1600, Folio; Francof. 1600, Folio; 1602, 1616, 1627, Octavo; *Opera omnia Anatomica & Medica*, Francof. 1627, Folio; in French à Paris, 1646, Folio; *Opera Anatomica, &c.* Hanov. 1601, Octavo.

JOHN

## cxxiv An Historical Compendium.

JOHN RIOLAN was born at Paris in the Year 1577, where he was afterwards Royal Professor of Anatomy and Botany, and first Physician to MARY of Medicis, Mother to LEWIS XIII.

He was an exceeding dextrous Anatomist, and elegant Writer; enriched Anatomy with many useful Discoveries, and appears well versed in the Writings of the Antients.

Amongst other Discoveries, he first took Notice of the Appendiculæ Pingues of the Colon, gave Names to the hepatic and cystic Ducts of the Liver, and observed, that the Ductus Communis was not furnished with a Valve, but, instead of that, with a kind of Rugosity, which, in some Degree, supplies the Place of one.

With respect to the Hymen, he thinks it a circular Membrane, placed across the Vagina, with a small Foramen in the Middle; and that, by the Laceration of this, the Carunculæ Myrtiformes are formed.

He allows of the Anastomoses of the epigastric and mammillary Arteries in Women, but not in Men; and has also some Observations, which are new, concerning the Canal of the Cervix Uteri, the Os Hyoides, Tongue, and a Ligament that is extended from the styloid Apophysis to the Angle of the inferior Maxilla\*.

CASPAR ASELIUS was born at Cremona, and was Professor of Anatomy at Pavia. He is celebrated for being the first, amongst the Moderns,

---

\* His Works are, *Schola Anatomica*, &c. Paris. 1607, 1609, Octavo; Genev. 1624, Octavo; *Anatome Corporis humani*, &c. Paris. 1610, Folio; *Osteologia*, &c. Paris. 1614, Octavo; *Anthropographia*, Paris. 1618, Octavo; *ibid.* 1626, Quarto; *Opera Anatomica*, Lutet. Paris. 1649, Folio; *Opuscula Anatomica*, Paris. 1652, Duodecimo; *Enchiridion Anatomicum*, &c. Lugdun. Batav. 1649, Paris. 1658, Octavo; Jen. & Lips. 1674, Octavo; Lugd. Bat. 1675, Octavo; Francof. 1677, Octavo; and in French à Lyon. 1682, Octavo.

who took Notice of the lacteal Vessels in the Mesentery, which he describes as conveying the Chyle to a large Gland situated in the Center of the Intestines; but this Account, he confesses, is taken from the Appearances in brute Subjects.

He modestly declines the Honour of this Discovery, because he says that these Lacteals were known to HIPPOCRATES, ERASISTRATUS, and GALEN\*.

WILLIAM HARVEY, a celebrated Physician, was born at Folkstone in Kent in the Year 1577. He studied five Years at Padua, where he took a Doctor's Degree; afterwards took the same Degree at Cambridge; and, having been Physician to King JAMES I. and King CHARLES I. and President of the College of Physicians; he died in 1657, in the eightieth Year of his Age.

His Discovery of the Circulation of the Blood was of the utmost Importance, in Physic, of any that was ever made, and immortalized his Name: But as it has been frivolously disputed, whether the Honour of it belongs to him, I shall transcribe a Passage from WOTTON's Reflections on Antient and Modern Learning, which sets this Affair in a true Light.

“ This Discovery, first made perfectly intelligible by Dr. HARVEY, is of so very great Importance to shew the Communication of all the Humours of the Body with each other, that, as soon as Men were perfectly satisfied that it was not to be contested, which they were in a

\* This Discovery was made in 1622.

His Works are, *De Lactibus, seu Lacteis Venis, quarto Vasorum, Meferaicorum genere novo invento, Dissertatio, cum Figuris elegantissimis*, Mediolan. 1627, Basil. 1628, Lugd. Bat. 1640, Quarto; 1641, Octavo.

It is also extant with the Works of SPICELLIUS, revised by Vander LINDEN, and in VESLINGIUS, illustrated by BLASIUS.

“ few Years ; a great many put in for the Prize,  
 “ unwilling that HARVEY should go away with  
 “ all the Glory.”

At last, HARVEY printed a Discourse, on purpose, upon this Subject, at Francfort, in 1628. This gave him a just Title to the Honour of so noble a Discovery ; since what his Predecessors have said before him was not enough understood, to form just Notions from their Words. One may also observe, how gradually this Discovery, as well as all abstruse Truths of human Disquisition, was explained to the World.

HIPPOCRATES first talked of the usual Motion of the Blood ; PLATO said, that the Heart was the Origin of the Veins and Blood that was carried about every Member of the Body ; ARISTOTLE also, somewhere, speaks of a recurrent Motion of the Blood : Still all this was only Opinion and Belief. It was rational, and became Men of their Genius ; but not having, as yet, been made evident by Experiments, it might as easily be denied, as affirmed.

SERVETUS first discovered, that the Blood passes thro' the Lungs ; COLUMBUS went farther, and shewed the Uses of the Valves of the Heart, which let the Blood in and out of their respective Vessels, but not in the self-same Road. Thus the Way was just open when HARVEY came, who built upon the first Foundations.

To make his Work still the easier, the Valves of the Veins, which were discovered by Father PAUL the Venetian, had not long before been explained by FABRICIUS AB AQUAPENDENTE, when the Circulation was yet more clearly demonstrated.

There was one Thing still wanting, to complete this Theory ; and that was, the Knowledge how the Veins received that Blood which the Arteries discharged.

1. It was believed, that the Mouths of each Sort of Vessels joined into one another. That Opinion was soon laid aside; because it was found, that the capillary Vessels were so extremely small, that it was impossible, with the naked Eye, to trace them. This put them upon imagining, that the Blood ouzes out of the Arteries, and is absorbed by the Veins, whose small Orifices receive it as it lies in the Fibres of the Muscles, or in the Parenchyma of the Bowels; which Opinion has been generally received by most Anatomists since Dr. HARVEY's Time. But LEEUWENHOECK has found in several Sorts of Fishes, which were more manageable by his Glasses than other Animals, that Arteries and Veins are really continued Siphons, variously wound round each other towards their Extremities, in numberless Mazes, all over the Body; and others have found what he says to be very true, in a Water Newt: So that this Discovery has passed uncontested.

And since it has been constantly found, that Nature follows like Methods in all Sorts of Animals, where she uses the same Sorts of Instruments; it will always be believed, that the Blood circulates in Men after the same Manner as it does in Eels, Perches, Carps, Bats, and some other Creatures, in which LEEUWENHOECK tried it: Tho' the Ways how it may be visible to the Eye, in human Bodies, have not, that I know of, been yet discovered.

But THOMAS BARTHOLINE, and CONSENTINE, have raised up a modern Rival to HARVEY, for the Honour of the Discovery of the Circulation, which is the celebrated Father PAUL. What they relate, amounts only to this; that, in a Manuscript of Father PAUL, that was left in the Hands of Father FULGENTIUS at Venice, the Particulars of the true Circulation of the Blood, as published

by HARVEY, are contained : And hence they conclude, that he communicated it to FABRICIUS AB AQUAPENDENTE, who told it to HARVEY whilst he was at Padua.

But the Truth of this Affair appeared to be, that, after HARVEY's Return to England, he made a Present of his Book, just then published, to the Venetian Embassador ; who, immediately after going Home, lent it to Father PAUL, whose Curiosity led him to make some Extracts from it, which are contained in the Manuscript above mentioned.

What made this Story the more likely to be true, was Father PAUL's Sagacity in anatomical Researches, who first observed the Contraction and Dilatation of the Pupil of the Eye ; and is said to have communicated to AQUAPENDENTE his Knowledge of the Valves in the Veins.

Besides this Discovery of the Circulation, HARVEY made several with respect to the Generation of Animals\*.

CASPAR BARTHOLINUS was a Dane, and born in the Year 1585. After visiting most of the famous Universities, and attending the Lectures of the most celebrated Professors, he was made Royal Professor at Copenhagen ; then turned his Studies to Divinity, and died in 1630, in the Forty-fifth

---

\* His Works are, *Exercitatio Anatomice de Motu Cordis & Sanguinis in Animalibus*, Francof. 1628, Quarto ; Lugd. Bat. 1639, Quarto ; ibid. 1647 ; *Cum Refutationibus Æmilii Parisiani*, 1647 ; Patav. 1643 ; it is likewise in a Book intituled, *Recentiorum Disceptationes, de Motu Cordis, &c.* Lugd. Bat. 1647, Quarto ; then it appeared in English, printed at Rotterdam, 1671 ; *Exercitationes duæ de Circulatione Sanguinis*, Roterod. 1649 ; *Epistola ad Johan. Dan. Horstium de Inventis Asellii & Pequeti*, are in the Decad of Medical Epistles of JOH. DAN. HORSTIUS. *Exercitationes de Generatione Animalium*, Lond. 1651, Quarto ; Amstel. 3651, 1652, Duodecimo ; Hag. Comit. 1630, Duodecimo ; in English at London, 1653.



Year of his Age. He was contemporary with HARVEY\*.

TO CASPAR BARTHOLINE I shall subjoin his Son and Grandson.

THOMAS BARTHOLINE; a Physician, was the Son of CASPAR BARTHOLINE, and born at Copenhagen in 1616. He was Professor at the Place of his Birth, enriched Anatomy with many useful Discoveries, and claims the Glory of having first observed the lymphatic Vessels: But the Pretensions of OLAUS RUDBECKIUS, and JOLLIFFE, an English Physician, to the same Discovery, render his Title to it doubtful.

RUDBECKIUS published his Observations much about the same Time as those of BARTHOLINE appeared; and Dr. JOLLIFFE shewed the same to several of his Friends, but without publishing any Thing concerning them: The Discoveries being undoubted, and all three working upon the same Materials, there seems no Reason to deny any of them the Glory of their Inventions. The Thing which they found was, that there are innumerable small clear Vessels in many Parts of the Body, chiefly in the Abdomen, which convey a colourless Juice either into the common Receptacle of the Chyle, or else into the Veins, there to mix with the Blood. He also claims a Title to the Discovery of the thoracic Duct; but this is also disputed with him by Van HORNE and PEQUET†.

He

\* His Works are in much Esteem, which are, *Anatomica Institutiones*, Albæ 1661, Argentor. 1626, Rostoch. 1626, Gollar. 1632, Oxon. 1632. These Institutions were enlarged by BARTHOLINE the Son, and published in different Years and Places. They were published in the German Tongue, Hafn. 1648. *Controversiæ Anatomicae*, Gollar. 1531; *Enchiridion Physicum*, Argent. 1652.

† His Works are, *Anatomia ex Caspári Bartholini, Parentis Institutionibus*, &c. Lugd. Bat. 1641, ibid. 1645, ibid. 1651; *Hagæ Comitum* 1655, ibid. 1660, ibid. 1663; *Roterod.* 1669, ibid. 1673; Vol. I. h. *Andr.*

He left two Sons, CASPAR and THOMAS ; the former of whom published many of his Father's Works. He also wrote upon the Ovaries of Women, Generation, and the Structure of the Diaphragm ; and is said to have first discovered the inferior and lesser salivary Ducts. He farther speaks of a new Method of preparing the Viscera for anatomical Uses\*.

*Anatomica Aneurismatis dissecti Historia*, Panormi 1664; *De Lacteis Thoracis, in Homine Brutisque nuperrime observatis, Historia Anatomica*, Hafniæ 1652, Lond. 1652, Paris. 1653, Genevæ 1654, Lugd. Bat. & Ultra Traject. 1654. It is also in the *Messis Aurea* of SIBOLDUS HEMPSTERHUIS, printed Heidelberg. 1659, and with his own *Opuscula*, Hafniæ 1670. *Vasa Lymphatica, nuper Hafniæ in Animantibus inventa, & in Homine*, Hafniæ 1653, Paris. 1654. They are also extant with SIBOLDUS HEMPSTERHUIS *Messis Aurca*, Heidel. 1659; and also with his own *Opuscula*, printed Hafniæ & Amstelod. 1670. *Historia Nova Vasorum Lymphaticorum*, published with LE CLERC, and MANGETUS's *Bibliotheca Anatomica*, printed Genev. 1685; *Dubia Anatomica*, Hafniæ 1653, Paris. 1653; *Defensio Vasorum Lacteorum, &c.* Hafniæ 1655; and with his *Opuscula Anatomica*, 1670. *Historiarum Anatomicarum, Centuria prima & secunda*, Hafn. 1654; *Historiarum Anatomicarum, Centuria tertia & quarta*, ibid. 1657; *Historiar. Anatomicar. Centuria quinta & sexta*, Hafn. 1661; *Vindiciæ Anatomicae*, Hafn. 1648; *Opuscula Nova Anatomica*, Hafn. & Amstelod. 1670; *Observationes Anatomicae Petri Pæwi*, printed in the third and fourth Centuries of his own Observations, Hafn. 1657; *Collegium Anatomicum*, Hafniæ 1651; *Specilegium primum, ex Vasis Lymphaticis*, Amstelod. 1661, Hafniæ 1655, 1658, Rostochii 1660; also with his *Opuscula*, printed Hafniæ 1670; *Specilegium secundum, ex Vasis Lymphaticis*, Amstelod. 1660; *Specilegia bina ex Vasis Lymphaticis*, Amstelod. 1661, and with his own *Opuscula nova Anatomica*, Hafniæ 1670; *Dissertatio Anatomicæ de Hepate defuncto*, Hafn. 1661, and with his *Opuscula Anatomica Nova*, Hafniæ 1670; *Responsio de Experimentis Anatomicis, Bilis, &c.* Hafniæ 1661, Amstelodami 1661; *De Hepatis, Exautorati Causa Desperata*, Hafniæ 1666; *De Cerebri Substantia pingui, &c.* Hafniæ 1669; *De Anatomie Practica, ex Cadaveribus, mortuosis adornanda Consilium, &c.* Hafniæ 1674; *De Pulmonum Substantia & Motu Diatribe*, Hafniæ 1663, Lugd. Bat. 1672.

\* His anatomical Works are, *De Ovariis Mulierum, &c.* Romæ 1677. Amstelod. 1678, Norimb. 1679; *Epistola de Nervosum, Usu in Musculorum Motu*, Paris. 1676; *Diaphragmatis Structura nova*, Paris. 1676; *Administrationum, Anatomicarum, Specimen*, published with Michaëlis Lysen, Cultrum Anatomicum, Francof. 1679; *Exercitationes Miscellanæ*, 1675. There are likewise several of his anatomical Pieces printed in the *Acta Hafnientia*.

From

From the Time of the great HARVEY, there have been such a Multitude of anatomical Writers, that a particular Detail of them would, of itself, require a Volume: I shall therefore only give a Catalogue of the principal, and take some Notice of their Discoveries, when of any Importance. I must, however, remark, that it would have been fortunate for Anatomy, and Students in this Science, if Authors could have contented themselves with publishing their own Discoveries, and animadverting upon the Errors of others: But, instead of doing this, many have thought that a Discovery, sometimes trifling enough, or a Professor's Chair, have entitl'd them to write an entire System; thus making it necessary to search large Volumes for Discoveries that a few Pages were sufficient to contain.

GOTTOFREDUS BIDLOO was Professor of Anatomy and Surgery at Leyden, and published 105 magnificent Figures, of different Parts of the Body, Amst. 1685, in a very large Folio; some of which are said not to be according to Nature.

THEOPHILUS BONETUS collected, with immense Labour, and published, a vast Number of Dissections, that had been made upon Bodies which died of Distempers, or Casualties; thereby excellently explaining the immediate Causes of Diseases and Death.

This Work is, perhaps, the most valuable Piece that the Moderns have produced, and the best adapted to render a Physician perfectly acquainted with the Indispositions of the human Body\*.

RICHARD

\* His large Work, intituled, *Sepulchretum sive Anatomia Practica*, was first published in two Volumes, Genevæ 1679, Folio.

MANGETUS published another Edition, with considerable Additions, in three Volumes, Lugd. 1700.

RICHARD LOWER wrote an excellent Treatise on the Heart; wherein he advances several Things that are new, with respect to the spiral Order of the Fibres that compose this Part. There are several Editions of this Work. Those I have seen are, Amstelod. 1669, Lond. 1670. MAGNET and LE CLERC have also printed it in their *Bibliotheca Anatomica*.

MARCELLUS MALPIGHIUS flourished in the last Century, and was deservedly celebrated for his great Skill and singular Sagacity in anatomical Researches.

His Industry was not confined to the more perfect Animals, but was extended to Insects, and even Vegetables, to the great Improvement of natural Knowledge, and his own Honour. He was Member of the Royal Society of London.

Amongst other Discoveries, he found, by his Microscopes, that the cortical Part of the Brain consists of an innumerable Company of very small Glandules, which are all supplied with Blood by the capillary Arteries; and that the animal Spirit, which is separated from the Mass of Blood in these Glandules, is carried from them into the Medulla Oblongata, thro' little Pipes, one of which belongs to every Gland, whose other End is inserted into the Medulla Oblongata: And that these numberless Pipes, which, in the Brain of some Fishes, look like the Teeth of a small Ivory Comb, are properly that which all Anatomists, after PICCOL-HOMINUS, have called Carpus Callosum, or the medullary Part of the Brain.

---

There is also another Piece on the same Subject, intituled, *Prodrōmus Anatomiae Practicae, sive de Abditis Morborum, Causis, ex Cadaverum dissectione revelatis, Libri primi Pars. prima, de Doloribus Capitis, ex illius apertione Manifestis*, Genev. apud FRANCISCUM MIEGE, 1675, Octavo.

Before

Before his Time, the Texture of the Tongue was but guessed at, which occasioned great Disputes concerning the Nature of its Substance; some thinking it to be glandulous, some muscular, and others of a peculiar Nature, not to be matched in any other Part of the Body.

This, therefore, MALPIGHIVS examined with his Glasses, and discovered, that it was cloathed with a double Membrane; that, in the inner Membrane, there are abundance of small Papillæ, which have Extremities of Nerves inserted into them, by which the Tongue discerns Taste; and that, under this Membrane, it is of a muscular Nature, consisting of numberless Heaps of Fibres, which run, all manner of Ways, over one another, like a Mat.

The Lungs, as most of the other Viscera, were believed to be of a parenchymous Substance, till MALPIGHIVS found, by his Glasses, that they consist of innumerable small Bladders, that open into each other, as far as the outermost, which are covered by the outer Membrane that incloses the whole Body of the Lungs; and that the small Branches of the Trachea Aspera are all inserted into these Bladders, about every one of which the Veins and Arteries are entwined, in an almost inconceivable Number of Nets and Mazes, that the inspired Air may press upon, or mix with, the Mass of Blood, in such small Parcels as the Antients had no Notion of.

Till MALPIGHIVS discovered the Texture of the Liver by his Glasses, its Nature was very obscure: But he has found out, that the Substance of the Liver is formed of innumerable Lobules, which are very often of a cubical Figure, and consist of several little Glands, like the Stones of Raisins, so that they look like Bunches of Grapes, and are each of them cloathed with a distinct Membrane;

that the whole Bulk of the Liver consists of these Grape-stone-like Glands. From whence it is plain, that the Liver is a glandulous Body, with its proper excretory Vessels, which convey away the Gall that lay before in the Mass of Blood.

He also discovered, that the Substance of the Spleen, deducting the numerous Blood-Vessels and Nerves, as also the Fibres that arise from its second Membrane, and which support the other Parts, is composed of innumerable little Cells, like Honey-combs, in which there are vast Numbers of small Glandules that resemble Bunches of Grapes, and which there hang upon the Fibres, and are fed by Twigs of Arteries and Nerves, and send forth the Blood, there purged, into the Ramus Splenicus, which carries it into the Liver; to what Purpose, is not yet certainly discovered.

The Mechanism of the Reins was wholly unknown till MALPIGHIUS found it out. He, by his Glasses, discovered, that the Kidneys are not one uniform Substance, but consist of several small Globules, which are all, like so many several Kidneys, bound about with one common Membrane; and that every Globule has small Twigs from the emulgent Arteries that carry Blood to it; Glands, in which the Urine is strained from it; Veins, by which the purified Blood is carried off to the emulgent Veins, thence to go into the Cava; a Pipe to convey the Urine into the great Basen in the Middle of the Kidney; and a Nipple, towards which several of those small Pipes tend, and thro' which the Urine ouzes out of them into the Basen.

This clear Account of the Structure of the Reins, has effectually confuted several Notions, that Men had entertained, of some secondary Uses of those Parts; since hereby it appears, that every Part of the Kidneys is immediately and wholly subservient

servient to that single Work of freeing the Blood from its superfluous Serum and Salt.

He also made some Observations concerning the lymphatic Vessels and Glands, which are new\*:

DOMINICUS DE MARCHETTIS succeeded VESLINGIUS, as Professor of Anatomy, at Padua.

At the same Place lived PETRUS DE MARCHETTIS, who applied himself to Surgery.

The Works of both are in good Esteem†.

HENRICUS MEIBOMIUS discovered some Vessels of the Eye-lids which had not been taken Notice of before, which he gives an Account of in an Epistle that he wrote ||.

WALTER NEEDHAM, an English Physician of the last Century, gave a good Account of the Membranes which involve the Fœtus, in his Book‡.

\* His Works are, *Observationes Anatomicæ, de Pulmonibus*, printed with *Bartholini de Pulmonum Substantia, & Motu Diaribe*, Hafniæ 1663; Lugd. Bat. 1672; *Dissertatio Epistolica de Bombyce*, Lond. 1669; *De Viscerum, Nominatim Pulmonum, Hepatis, &c. Structura*, Amstelod. 1669, Jenæ 1677; they are also in LE CLERC and MANGETUS's *Biblioth. Anatomica*, printed Genev. 1685; *Epistola Anatomica*, ibid. 1669; and in LE CLERC and MANGETUS's *Biblioth. Anatomica*, printed Genev. 1685; *Anatomes Plantarum*, Lond. 1675; *Anatomes Plantarum pars altera*, ibid. 1679; *Dissertatio Epistolica de formatione Pulli in Ovo*, Lond. 1666; it is also in the *Biblioth. Anatomica* of LE CLEEC and MANGETUS, printed Genev. 1685; in which are likewise contained his Dissertations; *De Cornuum Vegetatione*; *De Utero, & Viviparorum Ovis, & de Pulmonibus Epistolæ*; *Dissertatio de Polypo Cordis*; *Epistolæ quædam circa illam de Ovo Dissertationem, &c. Appendix Repetitas auctasque de Ovo incubato Observationes continens*.

† That of DOMINICUS DE MARCHETTIS is, *Anatomia, cui Responsiones ad Riolanum Anatomicum, Parisiensem in ipsius Animadversionibus contra Veslingium additæ sunt*, Patav. 1652, ibid. 1654, Hædervici 1656; together with *Petri de Marchettis Nova Observatio, & Curatio Chirurgica*.

|| *De Vasis Palpebrarum, Novis Epistola, Vir Cl. Tr. Isclam Langelot, Helmit. 1666*; *De Medicorum Historia Scribenda Epistola, ad V. Cl. Georg. Hieronym. Velschium, Helmit. 1669*.

‡ *De Formatu Fœtus*, Lond. 1667, Octavo; Amstelod. 1668, Duodecimo.

JOHANNES PEQUET, of Dieppe, an Author of the last Century, rendered his Name famous by his Discovery of the Receptacle of the Chyle; which, however, it is said, BARTHOLOMÆUS EUSTACHIUS was acquainted with before him. But the World is obliged to PEQUET for shewing, beyond all Contradiction, that the lacteal Vessels convey the Chyle to this Receptacle; and for proving, that it is thence carried, by particular Vessels, through the Thorax, almost as high as the left Shoulder, and there thrown into the left subclavian Vein, and so directly carried to the Heart\*.

JOHANNES CONRADUS PEYER, a Native of Schaffhausen in Switzerland, is famous for having first given an accurate Account of the intestinal Glands, which, in a State of Health, separate a Fluid, for the Lubrication of the Intestines, and which in Diarrhœas, or upon taking a Purge, supply the extraordinary Discharge that happens upon these Occasions†.

HENRY RIELEY was Fellow of the College of Physicians; and, at the latter End of the last Century, published a Treatise on the Brain; in which he makes some Observations that had escaped the Notice of WILLIS and VIEUSSENS. His Book is intituled, “ The Anatomy of the Brain; con-

\* His Works are, *Experimenta, nova Anatomica*, Harderv. 1651, Paris. 1654. To this Edition there is added, *Dissertatio de Thoracis Laevis*, &c. &c. Amstelod. 1661. They are also extant with the *Messis Aurea Siboldi Hemstercius*, Lugd. Bat. Heidelberg. 1659; also in the *Biblioth. Anatomica* of LE CLERC and MANGETUS, Genev. 1685, and with most Editions of the *Anatomia Reformata Thomæ Bartholini*.

† His Works are, *Exercitatio Anatomico-Medica, de Glandulis Intestinarum*, Schaffhausæ 1677, Amstelod. 1682. This is in the *Biblioth. Anatom.* of MANGETUS and LE CLERC. *Pæonis & Pythagoræ Exercitationes Anatomicae*, Basil 1682; *Methodus Historiarum Anatomico-Medicarum*, &c. 1679; *Pænergia Anatomica & Medica*, Amstel. 1682; *Experimenta Nova circa Pancreas*, extant with the *Biblioth. Anatom.* of LE CLERC and MANGETUS.



“ taining its Mechanism and Physiology: To-  
 “ gether with some new Discoveries and Cor-  
 “ rections of modern Authors, upon that Subject.  
 “ To which is annexed, a particular Account of  
 “ Animal Functions, and Muscular Motion; il-  
 “ lustrated with Cuts.” London, printed in the  
 Year 1695.

OLAUS RUDBECKIUS, of Upsal in Sweden, has a great Dispute with THOMAS BARTHOLINE about the Discovery of the lymphatic Ducts, to which both laid Claim.

It is certain, that Dr. JOLLIFFE, in England, remarked these Vessels much about the Time, or somewhat before, these Antagonists observed them; and I see no Reason why all three may not equally pretend to the Glory of the Discovery, since it is probable that neither of them took the Hint from each other.

FREDERIC RUYSCH was born at the Hague, on the 23d Day of March 1638. He was the Son of HENRY RUYSCH, Secretary to the States General, and to ANNE Van BERGHEM. The Family from which he was descended, was originally of Amsterdam, where, from the Year 1365, his Ancestors had, without Interruption, bore the most honourable Offices of the State, till the Year 1576; when a War happening betwixt Spain and the States, occasioned a Revolution in the Fortunes of the Family.

But RUYSCH is far less considerable on account of his Extraction, than his distinguished Merit, as

---

\* His Works are, *Exercitatio nova Anatomico*, &c. printed Aroliæ 1653, Lugd. Bat. 1654; it is also printed with the *Alceffis Aurea* of SIBOLDUS HEMPSTERHUIS, Heidelberg. 1659; and with the *Biblioth. Anatom.* of LE CLERC and MANGETUS, Genev. 1684; *Insidie Struæ Olai Rudbeckii Sueci*, &c. Lugd. Bat. 1654; *Pro Ductibus Hepaticis, contra Bartholinum*, Lugd. Bat. 1654; *Epistola ad Thomam Bartholinum, de Vasis Serosis*, Upsaliæ 1657.

## cxxxviii An Historical Compendium.

a Member of Society, a Physician, and an Anatomist.

In the Year 1664 he took his Degree of Doctor of Physic in the University of Leyden, and had, very soon after, a very fine, but at the same Time deplorable Opportunity, put into his Hands, of convincing the World, with how great Justice that Dignity was conferred upon him: For the Plague began to rage all over Holland; and he had the Care of those, who were infected at the Hague, committed to him.

This Office, whatever Share of Glory it might procure him, was, nevertheless, far from being desirable in itself. But it is no uncommon Thing for Merit and Learning to subject their Possessors to Inconveniences, from which the Ignorant and Illiterate are entirely free.

But his principal Business, and the Employment that engrossed most of his Time, consisted in carrying Anatomy to that noble Height of Perfection which it had never before arrived at. Anatomists had long contented themselves with such Instruments as were judged necessary for separating those solid Parts, the particular Structures or mutual Relations of which they wanted to discover.

REGNIER DE GRAAF, an entire Friend and intimate Acquaintance of RUYSCH, was the first who, in order to discover the Motion of the Blood in the Vessels, and the several Courses it took during Life, invented a new Species of Syringe, by means of which he filled the Vessels with some high-coloured Substance, which sufficiently discovered the Road taken by itself, and, consequently, that taken by the Blood in a living Animal.

This Invention was, at first, approved of; but the Practice was, soon after, discountenanced, because the Matter made its Escape gradually, and left the Preparation good for nothing.

JOHN

## An Historical Compendium. cxxxix

JOHN SWAMMERDAM endeavoured to supply this Defect in DE GRAAF's Invention, and happily concluded, that there was a Necessity for using some warm Substance, which, becoming gradually cool, in Proportion as it flowed into the Vessels, might at last, when arrived at their Extremities, lose the Nature of a Fluid, and, by that means, become capable of being retained in the Vessels. This, no doubt, required a very nice and discerning Judgment, both with regard to the particular Quality of the injected Matter, its due Degree of Heat, and the just Momentum, or Proportion of Force, with which it was to be impelled.

By this means, SWAMMERDAM first rendered the capillary Arteries and Veins of the Face visible; but he did not long persist either in the Use or Improvement of his new Invention: For an Excess of Piety, soon after, spoiled his anatomical Turn, and made him look upon such Practices as impious.

The devout SWAMMERDAM was, no doubt, afraid of rivalling the Almighty in the Perfection of his Works: But his Fears, in this Particular, were ill founded. And as the most exalted Degrees of Devotion rarely extinguish all the Motions of Vanity in the Heart; so SWAMMERDAM was tempted to communicate his Invention to his Friend RUYSCH; who was not only fond of, but afterwards practised it, without any Fear of offending God.

Upon his first Trial, he found the Experiment to succeed; and, in all Probability, produced a more perfect Preparation than SWAMMERDAM himself had done. The Vessels were so curiously injected, that the remotest Parts of their Ramifications, which were as slender as the Threads of a Spider's Web, became visible; and, which is still more surprising, sometimes were not so with-

out

## cxl. An Historical Compendium.

out the Assistance of a Microscope. What, then, must the Nature of that Substance be, which is, at once, so fine as to enter the imperceptible Cavities of these Canals, and, at the same Time, is possessed of such a Quality, as to indurate itself there?

Small Ramifications were discovered, that were neither observable in the living, nor to be seen in dissecting the Bodies of those which were newly dead.

The entire Bodies of Children were injected: For the Operation was thought very difficult, if not entirely impossible, in Adults. Nevertheless, in the Year 1666, by Order of the States General, he undertook to inject the Body of the English Admiral BERCLEY, who was killed, on the 11th of June, in the Engagement betwixt the Dutch and English Fleets.

This Body, tho' very much spoiled, before RUYSCH put his artful Hand to it, was yet sent over to England, as curiously prepared as if it had been the fresh Body of an Infant; and the States General bestowed a Recompence, which was at once proportioned to their Grandeur, and the Artist's Merit.

Every Part of the injected Matter preserved its Consistence, Softness, Flexibility, and even gradually acquired fresh Degrees of Beauty with Time.

Bodies, with all their Viscera, were so far from having a nauseous Smell, that they even acquired an agreeable one; and that, too, in Cases where they smelled very strong before the Operation.

Every Part was preserved from Corruption by RUYSCH's Secret: A long Life afforded him the Pleasure of seeing, that his Preparations had, till then, been Proof against the Shocks of Time;  
and

and even put it out of his Power to ascertain the Length of their future Duration.

All his injected Bodies glow with the striking Lustre and Bloom of Youth; they appear like so many living Persons fast asleep; and their pliant Limbs pronounce them ready to walk. In short, the Mummies of RUYSCH were so many Prolongations of Life; whereas those of the antient Egyptians were only so many deplorable Continuations of Death.

When RUYSCH began to produce such surprising Preparations, abundance of incredulous People pronounced the Facts impossible; but he gently opposed their Obstinacy, with these Words: "Come, and see."—His Musæum was not only always open, but richly stored, if I may be allowed the Expression, with living Monuments of his Art, who were ready to pronounce in his Favour, and give the Lie to his Opposers.

A certain Professor of Physic very seriously advised him to renounce these Novelties, and tread in the safe and beaten Paths of his Predecessors: But as RUYSCH despised the foolish Admonition, the Doctor redoubled his Letters, and at last told him, that his Conduct, in that Particular, was inconsistent with the Dignity of a Professor; to all which RUYSCH replied, in a noble and truly LA-CONIC Strain, "Come, and see."

RUYSCH conceals the Name of the Professor, who was so friendly, or rather so foolish, as to give him this Advice; but he has acted otherwise with regard to RAW and BIDLOO, who were both famous for their Skill in Anatomy, and had openly declared themselves against him; especially BIDLOO, who confidently boasted, that he knew the Secret of preparing and preserving Bodies better than RUYSCH himself.

Upon this, RUYSCH asked him, Why, since it was so, he had not discovered such and such Parts? And why he had mangled his anatomical Tables with so many notorious Blunders?

Considering the Advantages of his Secret of Injections at that Time of Day, and the strong Curiosity that naturally reigned in RUYSCH's Breast, we need not be surprised, if the discovered Things, that had escaped the Notice of all that went before him, such as the bronchial Artery, which supplies the Lungs with Nourishment, before unknown to the most minute and accurate Anatomists; the Periosteum of the Ossicula Auditus, which were formerly looked upon as bare; the Ligaments belonging to the Articulations of these Ossicula. He likewise found, that the cortical Substance of the Brain was not glandular, as was commonly thought, but consisted of Vessels infinitely ramified: and that several other Parts, which were falsely looked upon as glandular Bodies, were no more than so many Congeries of simple Vessels, which only differed in their respective Lengths, Diameters, the Curves they described in their Courses, and the Distance of their Extremities from the Heart; Circumstances on which the various Secretions or Filtrations depend.

FREDERIC SCHREIBER, who writes his Life, when talking of the Extent and Importance of his Discoveries, seems animated with a kind of Enthusiasm, and expostulates the Matter in this warm Strain: "Who, before him, observed the Vessels  
" running thro' the Tunica Aranea, Patella, and  
" Acetabulum Coxæ? Who discovered the Vessels  
" diffused in that Membrane which surrounds  
" the Marrow of the Vertebrae? Or who found  
" out the Vessels in the Medullium of the Bones,  
" and in those Tendons and Ligaments which are  
" destitute of Blood?"

RUYSCH

RUYSCH, besides his Practice of Physic, and Professorship of Anatomy, was, by the Burgo-masters of Amsterdam, appointed Inspector of all those who were either killed or wounded in personal Quarrels. He was likewise, for the general Good of the State, created Master of the Midwives, who, generally speaking, were very ignorant of their Business. They were too hasty, for Instance, in forcibly extracting the Placenta, when it came not away; and were often rash enough to tear it, which frequently caused unavoidable Death. But RUYSCH taught them, tho' with some Difficulty, to wait with Patience for its coming away, or, at least, only gently to assist its Expulsion; because an orbicular Muscle, which he had discovered in the Bottom of the Uterus, naturally thrusts it outwards, and was even sufficient to expel it entirely.

At last, RUYSCH was created Professor of Botany, in the Exercise of which Office he gave the same Scope to his natural Genius which he had formerly done in Anatomy. The extensive Commerce of the Hollanders, supplied him with many exotic Plants, which he dissected and preserved with incomparable Art. He dextrously separated their Vessels from their Parenchyma, and, by that means, plainly shewed wherein their Life consisted. Thus Animals and Plants were equally embalmed, and equally sure of Duration, by the skilful Touches of RUYSCH's Hand.

His Musæum, or Repository of Curiosities, contained such a rich and magnificent Variety, that one would have rather taken it for the Collection of a King, than the Property of a private Man. But, not satisfied with the Store and Variety it afforded, he would beautify the Scene, and add an additional Lustre to the curious Prospect. He mingled Groves of Plants, and Designs of Shell-

work, with Skeletons and dismembered Limbs; and, that nothing might be wanting, he animated, if I may so speak, the Whole with apposite Inscriptions, taken from the best Latin Poets.

This Musæum was the Admiration of Foreigners. Generals of Armies, Embassadors, Electors, and even Princes and Kings, were fond of visiting it.

When PETER I. of Muscovy went into Holland in the Year 1695, he was so struck with the View of RUYSCH's Collection, that he tenderly kissed a little Infant, that sparkled with all the Graces of real Life, and seemed to smile upon him. On his second coming over in 1714, he purchased the Collection, and sent it to Petersburg; but the Industry and long Experience of RUYSCH soon furnished him with another.

In the Year 1727, he was chosen honorary Associate of the University of Petersburg; he was also a Member of the Leopoldine Academy in Germany, and of the Royal Society in London.

He died of a Fever, in the 92d Year of his Age, in 1731; and had this peculiar Advantage over most other learned Men, that he lived to see all that Opposition, which Malice and Envy made to his Merit, hushed and laid to Sleep.

RUYSCH published a great many Pieces, at different Times, which were, at last, reduced to a very confused and unaccountable Order, and printed, as the Title Page of the first Volume imports, Amstelod. apud JASSONIO WAESBERGIOS, 1737.

There is a Peculiarity, in one Work of his, that deserves to be taken Notice of; which is, that some Passages of his *Adversaria*, which he published in Latin and Dutch, are left untranslated into Dutch. What influenced this Author, in this Case, every one must judge for himself, from  
the



the Nature of the Passages untranslated. All his Works are comprized in two Volumes; Quarto; printed in Latin at Amsterdam.

CHRISTOPHER GUNTHER SCHELHAMMER, a Physician, who, in the latter Part of the last Century, was Professor of Physic at Jena for four Years, and afterwards removed into Denmark, where he spent the Remainder of his Days\*.

He makes various Observations relative to the Tongue, Larynx, salivary Glands, Diaphragm, Mesentery, Colon, Intestinum Cæcum, Receptaculum Chyli, Kidneys, Fingers, Nails, Lymph, and lymphatic Ducts; all which are worthy of Consideration.

Some detached Pieces of this Author are inserted in the German Ephemerides; as The Anatomy of a Mole, and a Treatise *De Calculo Cerebri*.

NICOLAUS STENO, a Dane, flourished about the Middle of the last Century. He enriched Anatomy with many valuable Discoveries. Amongst other Things, he observed the Ducts which convey Moisture to the Eye, for the Convenience of its Motion in the Orbit; and in 1662 described a salivary Duct, not taken Notice of before, that comes from the Glands which lie near the Ears. He also observed, that the Fibres of the muscular Membrane of the Pharynx are spiral in a double Order, one ascending, and the other descending, which run contrary Courses, and mutually intersect each other in every Winding. Besides these, he made several Observations concerning the Lympha Ducts. He was Great Uncle to WINSLOW.

---

\* He wrote a Book intituled, *In Physiologiam Introductio*, printed Helmæstad. 1681, Quarto; and another intituled, *De Auditu Liber Unus*, Lugd. Bat. 1684, Octavo. This last, and his *Epistolica Dissertatio, de Lympe Ortu, & Lymphaticorum Vascularum Causis*, are inserted in the *Bibliotheca Anatomica*. He also published an Edition of CONRINGIUS's Introduction to Physic, with Notes.

JOHANNES SWAMMERDAM was a celebrated Anatomist of Amsterdam, in the latter Part of the last Century; having been a favourite Pupil of Van HORNE, under whom he made a considerable Progress in the Art of dissecting and preparing Bodies.

DE GRAAF was Pupil to Van HORNE at the same Time with SWAMMERDAM, and is charged, by the latter, with Plagiarism, in stealing the Discoveries of their common Instructor, and claiming them as his own.

His Works are in very good Esteem, and are in the *Bibliotheca Anatomica*.

WILLIAM BRIGGS wrote an accurate Description of the Eye, with the Method of dissecting it, intituled, *Ophthalmographia*, Cambridge 1675, Octavo: This is also in MAGNETUS's *Bibliotheca Anatomica*. From the Structure of the Eye, he formed a Theory of Vision, which is in the *Acta Eruditorum*, 1683.

He discovered, that, in the Tunica Retiformis, which is contiguous to the vitreous Humour, the Filaments of the Optic Nerve there expanded, lie, in a most exact and regular Order, all parallel to one another; which, when they are united afterwards in the Nerve, are not shuffled confusedly together, but still preserve the same Order till they come to the Brain.

The crystalline Humour had before been discovered to be of the Figure of a double convex Lens, composed of two Segments of unequal Spheres, and not perfectly spherical, as the Ancients thought: So that this farther Discovery, made by BRIGGS, evidently shews, why all the Parts of the Image are so distinctly carried to the Brain, since every Ray strikes upon a separate Filament of the Optic Nerve; and all those Strings, so struck, are moved equally at the same Time.

He also describes the Ducts that convey Moisture to the Eyes, from the Glands in the Corners thereof, for the Convenience of their Motion in their Orbits.

DUPRE is an Author mentioned by GOELICKE, who informs us, that he published a Description of five Pairs of Muscles, which are concerned in moving the Head in different Directions, and that are inserted into the first and second Vertebrae of the Neck.

He, according to the same Author, described two Ligaments, that connect the Head either to the first or second Vertebra of the Neck.

FRANCIS GLISSON, an Englishman, was Professor of Physic at Cambridge, and Fellow of the College of Physicians. His principal Discovery was the Duct that conveys the Bile from the Liver to the Gall Bladder.

REGNERUS DE GRAAF was a Physician of Delft in Holland. He published several anatomical Pieces, which are in the *Bibliotheca Anatomica*. Two Dissertations of this Author, also, are extant in the German Ephemerides; one on the Indurations of the carotid Arteries, the other on a monstrous Uterus.

Many new Things, concerning the respective Subjects he treats of, are contained in the Works of this Author; but he is charged with borrowing them from Van HORNE, whose Pupil he was. It is, however, remarkable, that his Invention of the Syringe gave Birth to all the Discoveries in Anatomy that have, since his Time, been made by means of Injections.

NATHANIEL HIGHMORE published an anatomical Work, under the Title of, *Corporis humani Disquisitio Anatomica*, &c. Hagæ Comitum 1657, Folio.

The large Cavity of the superior Maxilla is called, from him, ANTRUM HIGHMORIANUM; but he is not the first Describer of it; for CASSENIUS takes Notice of it, under the Name of ANTRUM GENÆ.

JOHANNES Van HORNE was Professor of Anatomy at Leyden. His anatomical Pieces bear a very good Character; and he has the Reputation of having discovered the thoracic Duct, and is said to be the first who was acquainted with the true Structure of the Testicles: He also gave the Name of Ovaria to what was before called the Testes of Females.

DE GRAAF is said to be much obliged to him for the Discoveries he has published with respect to the Parts of Generation\*.

ANTONIUS MARIA VALSALVIA, a Physician, born at Imola, a City of Italy, was Professor of Anatomy at Bologna. His Treatise on the Ear is esteemed as an excellent Performance, and contains many Discoveries relating to that Organ. He also describes, and gives new Figures of, the Muscles of the Uvula and Pharynx.

GUICHARD JOSEPH DU VERNEY, a celebrated Anatomist, was born at Feurs in Forez, August 5, 1648. His Father, JACQUES DU VERNEY, was a Physician at that Place. He studied Physic five

---

\* His Works are, *Novus Ductus Chyliferus, nunc primum, delineatus, descriptus, & eruditorum, examini expositus*, Lugd. Bat. apud FRANC. HACKIUM, 1652, Quarto; *Microcosmos, seu brevis Manuductio ad Historiam Corporis humani, in Gratiam Discipulorum edita*, Lugd. Bat. apud JAC. CHOVET, 1660, Duodecimo; *ibid.* apud eundem, 1662, Duodecimo; *ibid.* apud eund. 1663, Duodecimo; Lipsiæ, apud JOHANNEM FRITSCHIUM, 1675, Duodecimo; *Leonhardi Botalli Opera omnia*, Lugd. Bat. apud DANIEL & ABRAH. A GAASBEAK, 1660, Octavo; *Prodromus Observationum suarum, circa Partes Genitales, in utroque sexu*, Lugd. Bat. 1668, Duodecimo; *Observationes Anatomico-Medicæ*, Amstelod. apud ABRAH. WOLFFGANG, 1674, Duodecimo.

Years at Avignon, and came to Paris 1667, where he was, soon after, employed in dissecting the Brain, before Assemblies of learned Men, who used to meet at the Abbé BOURDELET's, and at Mr. DENYS's, a learned Physician at Paris.

He acquitted himself so well on these Occasions, that, in 1676, he was received into the Royal Academy of Sciences as a Member, and afterwards read Lectures in Anatomy to the Dauphin.

In 1679, he was constituted Professor of Anatomy at the Royal Garden; and in 1683, he published his *Traité de l'Organe de l'Oüe*, which the following Year was translated into Latin, and printed at Neuremberg. This Treatise is in great Esteem.

He died September 10, 1730.

JOHANNES GEORGIUS VIRSUGUS was a Bavarian, and considerable Anatomist. He published no Work, but rendered himself famous by the Discovery of the Duct of the Pancreas, which discharges the Fluid, separated in that glandulous Substance, at the same Place where the Ductus Communis Cholodochus opens into the Duodenum. This he discovered in 1642.

He was, not long after, shot by an Italian, in his own Study; who, it was thought, had been hired to murder him.

His Name is sometimes spelled WIRTUMGUS.

THOMAS WHARTON was an English Physician, and in 1656 published a Treatise on the Glands, intituled, *Adenographia*; in which there are many curious Particulars, not known before.

In particular, he discovered a Duct, which, arising from the conglomerate Glands that are situated in the inner Side of the inferior Maxilla, conveys Saliva, which it discharges, near the Middle of the Chin, into the Mouth.

ANTHONY NUCK, a Dutch Physician, first practised his Profession at the Hague, and afterwards was Professor of Anatomy at Leyden. He was a most experienced and indefatigable Anatomist; having dissected with his own Hands, in the Space of eight Years, a great many human Subjects.

The Way how the aqueous Humour of the Eye, when by Accident lost, may be, and is, constantly supplied, was first found out and described by NUCK; who discovered a particular Canal arising from the internal carotid Artery, which, creeping along the sclerotic Tunic of the Eye, perforates the Cornea near the Pupil, and then, branching itself curiously about the Iris, enters into, and supplies, the aqueous Humour. He also discovered some salival Glands, not mentioned by WHARTON, STENO, BARTHOLINE, or RIVINUS.

He says, that the Breasts are Heaps of Glands, supplied with Blood by innumerable Ramifications of the axillary and thoracic Arteries; some of which, passing thro' the Breast Bone, unite with the Vessels of the opposite Side. These Arteries, which are inconceivably small, part with the Milk in those small Glands into small Pipes; four or five of which, uniting, make one small Trunk. Of these small Trunks, the large Pipes, which terminate in the Nipple, are composed; tho', before they arrive there, they streighten into so small a Compass, that a stiff Hair will just pass through.

The Nipple, which is a fibrous Body, has seven, eight, or more Holes, thro' which every Tube emits its Milk, upon Suction; and, lest (any one of them being stopped) the Milk should stagnate, they all have cross Passages into each other, at the Bottom of the Nipple, where it joins to the Breast.

He says, that the lymphæ Ducts arise immediately from the Arteries; and that many of them pass thro' the conglobate Glands which are dispersed in the Abdomen and Thorax, in their Way to the Receptacle of the Chyle, or those Veins that receive them.

His Works, which I have seen, are, *Adenographia*, *Sialographia*, & *Operationes*, & *Experimenta Chirurgica*, in three small Volumes, printed Lugd. 1722.

ANTHONY VAN LEEUWENHOECK has obliged the World with a great many Discoveries relative to Anatomy; particularly, by means of his Microscopes. It is not possible to give the Particulars of his Works, without transcribing them. Many detached Pieces of this Author were published at different Times; but his entire Works were printed Lugd. Bat. 1722.

He has made evident the Anastomoses of the Arteries with the Veins, and discovered a prodigious Number of Animalcula in the Semen of male Animals.

PHILIP VERHEYEN was born in the Year 1648. He intended originally to turn his Studies towards Divinity; but, having lost one of his Legs by a Mortification, he applied himself entirely to Physic, and was Professor of Anatomy and Surgery at Louvain, where he acquired great Reputation, and died of a Fever 1711, much regretted by the learned World.

His Anatomy bears an excellent Character, and has gone thro' several Editions; the third of which is that printed Brux. 1726, 2 Vols. 4to.

CLOPTON HAVERS was an English Physician, wrote admirably well on the Bones, and made some considerable Discoveries with respect to the Periostæum and Marrow. He discovered in every

## cliv An Historical Compendium.

“ cerned, and whose Structure should be so much  
“ considered, not only in this Operation, but in  
“ the High Way for cutting for the Stone. He,  
“ too, is the first who has plainly shewn, that the  
“ Elongation of the external Lamella of the Pe-  
“ ritonæum does not form the Tunica Vaginalis  
“ of the Testicles, as Authors say, but a Coat  
“ peculiar to the feminal Vessels, which he very  
“ properly calls TUNICA VASORUM SPERMATI-  
“ CORUM PROPRIA.”

And he afterwards observed, in reading PAULUS, that this Tunic was known to, and described by, him, by the Name of ἐλικοειδής, from the many Contorsions there are in those Vessels, which it covers.

FRANCIS NICHOLLS, a Physician, did not publish any Thing in Anatomy, that we know of, except his *Compendium Anatomico-Oeconomium*, and some Essays in the Philosophical Transactions. But his uncommon Application to this Science, and his singular Sagacity in anatomical Researches, make it hoped, that he will some Time oblige the World with an Account of his Discoveries.

The Editors of the Edinburgh Medical Essays some where observe, that ALBINUS had injected the Vessels of the Tunic of the crystalline Humour of the Eye; and seem to think it a new Discovery. On this Occasion I cannot forbear taking Notice, that NICHOLLS has injected these Vessels above twenty Years ago.

JOHANNES BAPTISTA MORGAGNUS was born at Forli, in the Ecclesiastical State, and Professor of Anatomy at Bologna. He made considerable Discoveries in Anatomy, relating to the Muscles of the Os Hyoïdes, Uvula, Pharynx, Tongue, Epiglottis, arytenoid and sebaceous Glands, Bladder, Uterus, Vagina, and Breasts.



His Works are, *Adversaria Anatomica*, which were collected and printed at Leyden 1723, 4to; *Epistolæ Anatomicae duæ*, Lugd. Bat. 1728, 4to.

Professor ALBINUS has published some anatomical Pieces, which are in much Esteem; and the World is in Expectation of more from the same Hand: His Works which have come to my Knowledge are, *Dissertationes de Fonculis*, Franc. 1681, Quarto; *Dissert. de Cantharidibus*, ibid. 1687, Quarto; *Dissert. de Paronychia*, ibid. 1694, Quarto; *Dissert. de Cataracta*, cum Fig. ibid. 1695, Quarto; *Dissert. de Ægilope*, ibid. Quarto; *Dissert. de Partu difficili*, ibid. 1696, Quarto; *Index Supellestilis Anatomicae Ravianæ, cum Ravi Vita & Calculosorum curatione*, cum Fig. Lugd. Batav. 1727; *Academicarum Annotationum Anatom. Patholog. Physiolog. & Zoograph.* in Three Parts, Lugd. 1756.

LAURENTIUS HEISTER, a celebrated Professor at Helmstead, published a Book intituled, *Compendium Anatomicum, Veterum, Recentiorumque, Observationes, brevissime Complectens*, Altorfii 1717, 4to; Altorf. & Norimb. 1732, & 1741.

This Compendium is of very little Service for Beginners; as being full of critical Observations which were doubtful in those Days, and have since been cleared up by Anatomists.

The Description of the Parts of the human Body are hardly pointed out; and it is amazing to me, that the Public does not pay more Regard to VERDIER's Abstract of the Anatomy of the human Body, which is built on WINSLOW's System, and now translated into English.

He has since published his Practical Observations, in one Volume, in German; which is translated into English, but not much esteemed.

Likewise, *Compendium Medicinæ Practicæ cui præmissa est de Medicina Mechanica præstantia Dissertatio*, Amstelod. 1743.

Also,

## clvi An Historical Compendium.

Also, *Institutiones Chirurgicæ, in quibus quicquid ad rem Chirurgicam pertinet, optima & novissima ratione per tractatur, atque in Tabulis multis æneis præstantissima ac maxime necessaria Instrumenta itemque artificia, sive encheirises præcipuæ & vincturæ Chirurgicæ representantur. Opus quadraginta fere annorum nunc demum, post aliquot Editiones Germanica Lingua evulgatas, in exterorum gratiam Latine altera vice publicatum.* Amstelod. apud JANSONIO-WAESBERGIOS, 1747\*.

ALEXANDER MONRO was a celebrated Professor of Anatomy at Edinburgh, and Author of a Treatise of OSTEOLOGY and NEUROLOGY, which are in great Esteem.

I do not know that he has published any Thing else, except some Pieces in the Medical Essays.

The last Edition of his OSTEOLOGY was printed Edinburgh, 1750.

JAMES BENIGNUS WINSLOW, Professor of Physic, Anatomy, and Surgery, in the University of Paris, Member of the Royal Academy of Sciences, and of the Royal Society at Berlin; in the Year 1723 published an excellent Work intituled, *Exposition Anatomique de la Structure du Corps humain*, Quarto.

It is esteemed as the best System of the solid Parts of the Body that has yet appeared; and is remarkable for Conciseness, Perspicuity, and the exact Order of the Work.

Besides his Anatomy, there are several Discoveries and Improvements that he has made in the Animal Oeconomy, which are inserted in the Memoirs of the Royal Academy of Sciences at Paris

---

\* In this System there are many Things out of Practice: And as for the Representation of the Chirurgical Instruments, they are very bad.

## An Historical Compendium. clvii

ALBERT DE HALLER, President of the Royal Society of Sciences at Gottingen, Member of the Royal Academy of Sciences at Paris, London, Berlin, Stockholm, &c. This ingenious and laborious Professor has favoured the World with the following Works, which came to my Knowledge.

*Experimenta & Dubia de Ductu Salivali Cosch-wifiano*, Leid. 1727, 4to; and in *Disp. Anat. Select.* Vol. I.

*Versuche, Scheveizerischer Gedichte.* The best Editions were printed at Bern 1732, 1734, 1743, in 8vo; Gottingen 1748, 1749, 8vo; the same 1751, 1752, 8vo; and also with a Variety of Lectures of the spurious Editions of *Gedan* 1743, 8vo; Tiguri 1750, 8vo; in German, in French, and in both Languages together. The French Translation was published at Gottingen and Zurich 1730, 8vo; and at Lyons 1752, 12mo; but these are not genuine Editions.

*Diff. de Musculis Diaphragmatis*, Bern. 1733, 4to; Lipsiæ and Leidæ 1738, both 4to; and in his anatomical Works printed at Gottingen 1751, 8vo.

*Quod Veteres eruditione antecellant modernos*, Bernæ 1734, 4to Oratio.

*De Foetu bicipiti ad pectora connato, Figuri in tempe Helvet.* 1735, 8vo; Hanov. 1738, 4to, with Additions and Copper Plates; the same was also published, in a more correct and extensive Manner, Gotting. 1751, 8vo; and amongst the anatomical Works.

*De Methodo studii Botanici*, Gotting. 1736, 4to; and, more correct, in the Botanical Works printed Gotting. 1749, 8vo.

*Quod Hippocrates Corpora Humana secuerit*, Programma, Gotting. 1734, 4to; and in the anatomical Works.

De

## clviii An Historical Compendium.

De Vasis Cordis, Disp. Gotting. 1737, 4to; and in Collect. Disp. Select. 2 Vols.

De Motu Sanguinis per Cor, Gotting. 1737, 4to; and in Collect. Disp. Select. 2 Vols.

De Veronicis quibusdam Alpinis, Gottingen 1737, 4to; Programmata duo.

De Pedicularibus Helveticis Specimen, Gotting. 1737, Disputatio.

De Valvula Eustachii, Progr. Gotting. 1738, 4to; Lipsiæ 1739, 4to; and in 2 Tom. Disp. Select.

De Vulnere Sinus Frontalis, Programma, Gotting. 1738, 4to.

Observationes Botanicæ ex itinere Hercinico, Gotting. 1748, 4to; and, more correct, in the Botanical Works.

De Allantoïde humana, Progr. Gotting. 1729, 4to.

Ex Femina gravida Observationes, Disp. Gotting. 1739, 4to; and in Disp. Select. Vol. V.

De Vasis Cordis Observationes itineratæ, Gotting. 1739, 4to; Progr. recus. in 2 Tom. Disp. Select.

Hermanni Boerhaave Prælectiones Academicæ in suas Institutiones rei Medicæ, with his Notes, 1 Tom. Gotting. 1739, 8vo. The Additions to this Volume were printed at the same Place 1740, 8vo; and a new Edition of the same Volume ibid. 1740.

Iter Helveticum Anni 1739, Gotting. 1740, 4to; and, more correct, in the Botanical Works.

Strena Anatomica, Progr. Gotting. 1740, 4to; and in his Anatomical Works.

De Ductu Thoracico, Disp. Gotting. 1741, 4to; and in Tom. I. Disp. Anat. Select.

De Diaphragmate, Progr. Gotting. 1741, 4to.

## An Historical Compendium. clxx

Observationes Myologicæ, Gotting. 1742, 4to, Progr.

Duorum Monstrorum Anatome, Gotting. 1742, 4to; and in the Anatomical Works.

De Fœte Capite Semibifido, Progr. Gotting. 1742, 4to; and in his Anatomical Works.

De Valvula Coli, Progr. Gotting. 1742, 4to; and in Vol. I. of Select Disputes of Anatomy.

De Omento Progr. 1 & 2, Gottingen 1742, and in the first Collection of the Anatomical Prints.

Enumeratio Methodica Stirpium Helveticarum, Gotting. 1742, Folio.

De Vera Nervi Intercoastalis origine, Disp. Gotting. 1743, 4to; and in Tom. II. Disp. Select. Anatom.

De Arteriis Bronchialibus & Oesophagicis, Gotting. 1743, 4to, Disp. and in Tom. III. Disp. Select. Anatom.

Iconum Anatomicarum partium Corporis humani, Fasciculus I. Gotting. 1743, 1747, Folio. The Printer hath added to these, two Plates of the celebrated HUBER.

Fasciculus VIII. Gotting. 1755, Folio. This last completes the whole Work.

Enumeratio Plantarum Horti & Ægri Göttingensis, Gotting. 1743, 8vo; and, with greater Additions, 1753, 8vo.

De Nervorum in Arterias imperio, Disp. Gotting. 1744, 8vo; and in Vol. Disp. IV.

Flora Jenensis C. H. Ruppil ex Schedis M. S. auctoris & meis Observationibus emendata & aucta, Jen. 1744, 8vo.

Herm. Boerhaave Consultationes Medico variis accessionibus auctæ, Gotting. 1744, 8vo; Paris. 1748. They were published in Latin and French 1749, 8vo; and HALLER caused them to be printed

clx An Historical Compendium.

printed, with greater Additions and Corrections, at Gotting. 1752, 8vo.

De fetu Cerebro destituto, Progr. Gotting. 1745, 4to, in Opuscul. Anatom. recusum.

De Generatione Monstrorum mechanica, Progr. Gotting. 1745, 4to, recusum in Opuscul. Anat.

De Viis feminis Observationes, Progr. 1745, 4to, recusum in Disp. Anat. Vol. V.

De alii genere naturali, Gotting. 1745, 4to; recusum libellum in Opusc. Botan. 1749.

H. Boerhaave de Morbis Oculorum prælectiones, Gotting. 1746, 8vo; much more correct, by the illustrious WILLICHUS, 1750, 8vo. They have been reprinted at Venice 1748, 8vo; and at Paris 1748, 8vo; afterwards in French 1749, 12mo. J. F. CLAUDE translated them into German from the first Edition, and published them at Nuremberg in 1751, 8vo.

De Respiratione Experimenta Anatomica, Gotting. 1746, 4to, recusa inter Opusc. Anatom. Patholog.

Eorum Pars prodiit, Gotting. 1747, 4to, & pariter inter Opuscula utraque recusa est.

Disputationum Anatomicarum Selectiorum, Vol. I. Gotting. 1746, 1750, 4to; Vol. VII. Gotting. 1751, 4to. The Index was composed by the illustrious WILLICHUS at Gottingen 1752, 4to.

Primæ Lineæ Physiologicæ, Gottin. 1747, 8vo. The French Translation appeared at Paris 1752, 8vo; and again at Gottingen, with the Additions of PETER TURIN. SAMUEL MIHLES translated them into English, which were published in London 1758, 8vo; 2 Vols.

Deux Memoirs sur le Mouvement du Sang, & sur les Effets de la Saignée fondés sur des Experiences, faites sur des Animaux, à Lausanne 1756.

## An Historical Compendium. clxi

De Foramine Ovali & Valvula Eustachii, Progr. Gotting. 1748, Fol. and in Fasciculo IV. Iconum.

Opuscula Botanica recensita & aucta, Gotting. 1749, 8vo.

De Rupto Utero, Progr. I. & II. Gotting. 1749, 4to; and amongst his Pathological Works.

De Gibbo, Progr. 1749, 4to; & in iisdem Opusculis.

De Morbis Ventriculi, Progr. 1749, 4to; & in iisdem Opusculis.

De Ossificatione præternaturali, Progr. 1749, 4to; & in iisdem Opusculis. Suecice in Act. Stockholm. 1749, 8vo; Gallice in Nouveau Magasin de Londres, 1750, 8vo.

De Aortæ & Venæ Cavæ gravioribus morbis, Progr. 1749, 4to; & in Opuscul. Patholog.

De Calculis Vesicæ Felleæ, Progr. 1749, 4to; & his Opusculis.

De Morbis Pulmonis, Progr. 1749, 4to; & in his Opusculis.

De Morbis quibusdam Uteri, Progr. 1749, 4to.

De Herniis congenitis, ibid.

H. Boerhaave de Methodo Studii Medici, with the ample Commentaries of HALLER, Amstelod. 1751, 4to; Venet. 1753, 4to.

Prüfung der Secte die an allem zweifeldt, which was translated from the French of PETER CROUSAZ and SAMUEL FORMEY, by HALLER; who added a Preface to it, and published it at Gottingen in 1751, 8vo. The same was also published in French at Neufchatel 1755, 12mo, by Monsieur SEIGNEUX.

Opuscula Anatomica recensita & aucta, Gotting. 1751, 8vo.

Reflexions sur le Systeme de la Generation de Mr. Buffons, Paris 1751, 12mo; erat Præfatio  
Vol. I. k ad

## clxii An Historical Compendium.

ad Editionem Germanicam, Tomi III. Historiæ Naturalis, extat enim in bibl. impart. T. V. p. 3.

Lettre à Monsieur de Maupertius, avec sa Réponse, Gotting. 1751, 8vo; Passim recusa, Germanice & Gallice, Francf. & Lips. 1751, & Hægæ com. 1752, 8vo.

De Morbis Colli, Progr. Gotting. 1753, 4to; hoc idem & sequentia ad N° 88, in his Opusculis recusa sunt.

De Calculis Felleis, Gotting. 1753, 4to.

De Induratis Partibus Corporis humani, Gotting. 1753, 4to.

De Monstrosis Fabricis, Gotting. 1753, 4to.

Herniarum Historiæ, Gotting. 1753, 4to.

De Morbis Uteri, ibid.

De Renibus coalitis & monstrosis, Gotting. 1750, 4to.

Dissertation sur les Parties sensibles & irritables des Animaux, Laufann. 1755, 12mo. The same is also inserted, in Swede, in the Transactions of the Academy of Stockholm of the Year 1753.

*The sensible Parts are,*

The Brain, Nerves, viz. their Medulla, and the following Parts, by means of the Nerves.

The Skin, Muscles, internal Membrane of the Stomach, Intestines, and Bladder; the Ureters, Breast, Uterus, Vagina, Penis, Tongue, Teeth, Eyes, and especially the Retina; the Tunica Choroides, but less than the Retina; the Heart, tho' not so much as the other Muscles.

The Viscera, Lungs, Liver, Spleen, Kidneys, and Glands, have few Nerves bestowed upon them; and, consequently, are not endowed with much Sensation.

*The insensible Parts are,*

The Cuticle, cellular Membrane, Fat, Tendons, Membranes which cover the Viscera and Ar-



## An Historical Compendium. - clxiii

Articulations, Mediastinum, Omentum, Mesentery, Dura and Pia Mater, Ligaments, Periosteum, Pericranium, Bones, Marrow, Cornea, and Iris.

The Arteries and Veins are insensible, except those which are accompanied with Nerves; such as the carotid, lingual, temporal, pharyngeal, labial, thyroïdal, and the Aorta near the Heart.

The Cornea, HAVER's Gland, and Tunics of the Nerves, are likewise insensible.

*The irritable Parts are,*

The Heart, Muscles, Diaphragm, Oesophagus, Stomach, Intestines, lacteal Vessels, thoracic Duct, Bladder, Glands and mucous Sinuses in Man, Uterus and Genitals; which last are endowed with an Irritability peculiar to themselves.

*The unirritable Parts are,*

The Nerves, Cuticle, Skin, Membranes, Arteries, Veins, cellular Membrane, Urethra, Ureters, Lungs, Liver, Spleen, Dartos and round Ligaments of the Uterus, Tendons, Ligaments, Periosteum, Meninges of the Brain, and the Iris.

The excretory Ducts can scarcely be called irritable, at least they require a very strong Irritation.

*The Parts which are both sensible and irritable, are,*

All those which have Nerves and muscular Fibres, the Muscles, Heart, the whole alimentary Canal, Diaphragm, Bladder, Uterus, Vagina, and Genitals.

Insects are irritable and sensible all over.

Disputationum Chirurgicarum Selectarum, Tom. I. & II. Lausan. 1755, 4to. Three more Volumes will be published.

Opuscula Pathologica, accedit Pars IV. Experim. de Respiratione, Lausan. 1755, 8vo.

## clxiv An Historical Compendium.

In other Journals have been published the following Works :

*In the Commentaries of the Royal Society of Sciences of Gottingen,*

Vol. I. of the Year 1752, Oratio de Utilitate Societatum ad Scientiarum augmentum conditarum.

De Hermaphroditis.

De cordis Motu a Stimulo nato, Diff. published in German in the Algem Magasin, Tom. III. and in French, Lausan. 1755, 12mo.

Observationes Botanicæ.

In Tom. II. Gottingen 1752 edito, de Partibus Corporis humani sensibilibus & irritabilibus, Pars I. & II. est Libellus idem N° 89.

Observationes Botanicæ.

In Tom. IV. Gotting. 1755, Experiments on the Motion of the Blood.

*In the Philosophical Transactions,*

N° 472. Steatoma Ovarii, in Opusculis Pathologicis recusum.

Cyani nova Species.

N° 474. Scirrhus Cerebelli, in Opusculis recusum.

N° 483, & 492. Historia Venæ Cavæ coalitæ & ultimi fenii, etiam in Opusculis recusa.

N° 494. Viæ Seminis cum Icon. & Experimenta de Respiratione.

*In the Transactions of Upsal,*

Anno 1742, Membranæ Papillaris descriptio. It is also inserted in the Academical Transactions of Sciences of Swedeland, and in Opusculis Anatomicis.

Amethystina novum Plantæ Genus.

*In the Literary Commerce of* Raræ aut Novæ  
Plantæ Alpinae, Annis 1732, 1733, 1734, 1735,  
1736;

Phthifici Dissectio, 1734, p. 187. & in Opus-  
culis Pathologicis.

Peripneumonia Historia, 1735, p. 12. & in  
iisdem Opusculis.

Observationes Anatomicæ, 1735, p. 107, &  
188.

Variolarum Anni 1735, Historia, 1736, p. 73.  
& in Opusculis Pathologicis.

Exemplum congenitum, 1736, p. 78. & in  
iisdem Opusculis.

Observationes Botanicæ, 1744, p. 7.

*Prefaces,*

Ad Weinmanni Magnum Opus Botanicum  
Præfatus, de nonnullis Iconographis inter Ger-  
manos egi.

Ad novam Editionem Historiæ morborum  
Urates lavienfium, Lausan. 1746, 4to.

Ad Opus Petri Croufazii Baylio oppositum, in  
Compendium redact. a clar. Viro Samuele Formey.  
Vide N° 78.

Ad Collectionem Itinerum quæ meis consiliis  
Gotting. prodit, Gotting. 1750, 8vo.

Ad Werthofii viri summi Poemata, Hanover  
1749, 8vo.

Ad Versionem Germanicam Operi Buffoniani,  
ad Tomum I. Lips. 1750, 4to.

De Utilitate Hypothesum ad Tomum III.

Objectiones contra clarissimi viri Systema de Ge-  
neratione. Hæc seorsum extat, uti dixi N° 80.  
pauculas etiam Tomo IV. notatas adpersi.

We omit the other short Prefaces.

*Journals,*

HALLER hath wrote a Preface in the Literary Tranfaction of Gottingen from 1747 to 1753 (which Year he went to his own Country): However, he assisted in the Composition of those Works from the Year 1745 to 1755.

He has also answered to several Criticisms in the *Bibliothèque Raisonné, Germanique, &c.*\*

I must not omit mentioning the ingenious Dr. PARSONS, Fellow of the Royal Society, for his endeavouring to explain, in his Crounian Lectures on muscular Motion, the human Physiognomy; wherein that learned Gentleman has quoted various Authors, to account for divers muscular Motions of the Face, which seem to me so rationally described, as being founded on the Structure of the Parts; tho' some, perhaps, will think, they are entirely built upon Hypotheses. For my own Part, I freely confess, they are as probable as the Circulation of the Blood, which no Body doubts of.

See his Human Physiognomy explained, in the Crounian Lectures on Muscular Motion, for the Year 1746; read before the Royal Society. Printed for C. REYMERS and L. DAVIS, over-against Gray's-Inn-Gate in Holbourn; Printers to the Royal Society.

Besides this, the learned World are indebted to this Gentleman for several Observations and Discoveries which he has made, in Physiology, Natural History, &c. which are dispersed in the Philosophical Transactions.

---

\* There are now in the Press, of the same Author, *Physiologiae Corporis humani Elementa*, 2 Vols. 4to. *Synopsis enumerationis Methodice Stirpium Helveticarum, emendata, aucta.* *Bibliotheca Anatomica, Botanica, Chirurgica, Practica, & Historia Naturalis. Orchidis Genus constitutum, pene elaboratum cum iconibus ad Comm. Gott. Tom. V. Col. 4to.*



The ART of Preparing and Preserving the Parts of HUMAN BODIES ; with that of Injecting their Vessels : According to Professor MONRO's Method.

**T**HE modern Invention of filling the Vessels of Animals with a coloured Fluid, which, upon cooling, grows hard, has contributed greatly to the Improvement of Anatomy ; not only by giving us an Opportunity to examine their Distribution, Situation, &c. but also by discovering a great Number of Vessels, which, without this Art, we should never have been acquainted with.

The Manner of filling the larger Trunks is known to most Anatomists ; but few are acquainted with the Art of filling the capillary Vessels : Therefore I shall lay down that which I have found (after many Trials) to be most successful ; and communicate all I know, of this Affair, without Reserve.

The Instrument used in injecting is, a well-made brass Syringe, to which several Pipes, of various Diameters, are fitted, and can be fixed by screwing them into the Body of the Syringe : The other Ends of these Pipes are entirely smooth, and exactly fitted to the Pipe which is put into the Blood Vessel, that, when both are pressed together, nothing can pass between them : To prevent the

## clxviii The Art of preparing and

latter from being forced off by the Injection, a cross Bar is fastened to it, which is to be held with the Fingers, and pressed close to the Pipe that is screwed into the Syringe; the Ends of this second Sort of Pipes are of different Diameters, and round each a Notch or Groove is made, for admitting the Thread that ties it to the Blood Vessel, so that it may not slip out. Besides these Pipes, one with a Valve, or Stop-cock, is necessary in filling the larger Vessels, to hinder the injected Liquor from running back; but it is still more useful, when the Vessels to be injected require more Liquor than the Syringe will contain at once: For, by turning the Cock, you may keep in the Injection while the Syringe is filled a second Time.

As to the Fluid to be injected, it is variously composed: The different Kinds of Glue, as Ichthyocola, Size, &c. dissolved, mix easy, and pass into very small Vessels, and will do very well in preparing a fine Membrane, where the Vessels are so small that the Eye cannot discover whether the transverse Sections are circular, or their Sides collapsed: But this Injection will not answer your Purpose when the larger Vessels are to be prepared; for, before the Glue will dry, the Subject will be spoiled. To prevent this, you may soak the Part in Spirit of Wine; but then the Injection becomes so brittle, that it will crack with the least handling; and if the Preparation is to be kept, the larger Vessels appear shrivelled, when the watery Part is evaporated.

The Method which I have found to succeed best is, first to inject so much coloured Oil of Turpentine as will fill the small Vessels, and afterwards to force the common Injection into the larger ones: The Oil will pass into smaller Tubes than the Colour in it can, and its resinous Parts will give a sufficient Adhesion to the Particles of  
the

## preserving Human Bodies, &c. clxix

the Colour, and prevent their separating; and this fine Injection mixes with the coarser so intimately, that you cannot discover that two Sorts were used.

The Colours used by Anatomists are various. Those I use are red, green, and sometimes blue. In the red Injection is put Vermilion, which gives a beautiful bright Colour, and is to be bought finely levigated; In the green we use distilled Verdigrise, because the Colour is brighter than the common Sort, and never runs into Knots, and dissolves in oily Liquors.

To make the fine Injection, pour a Pint of Oil of Turpentine on three Ounces of Vermilion, or Verdigrise, according to the Colour you want; stir them well, with a wooden Spatula, till they are thoroughly mixed, and then strain all thro' a fine linen Rag.

The coarser Injection is made thus: Take Tallow one Pound, white Wax five Ounces, Oil of Olives three Ounces; melt them over a gentle Fire, then add, of Venice Turpentine, two Ounces: When this is dissolved, sprinkle in, of Vermilion or Verdigrise, three Ounces; and then pass all thro' a warm linen Cloth. When you design to make it run far in the Vessels, add some Oil of Turpentine immediately before you use it.

The next Thing to be considered is, the Choice and Preparation of the Subject; for which observe the following Rules:

1. The younger the Subject is, the farther the Injection will go.
2. The more the Fluids have been exhausted in Life, the greater will be the Success of the Operation.
3. The less solid the Part, the more Vessels will be filled.
4. The more membranous and transparent the Parts are, the better the Injection will appear.

In preparing a Subject the principal Things are; to dissolve the Fluids, empty the Vessels, relax

## clxx The Art of preparing and

relax the Solids, and prevent the Injection cooling too soon. First, Macerate the Body or Part to be injected, a considerable Time in Water, so warm, that you can hold your Hand in it, which will relax the Vessels, dissolve the Blood, and keep the Injection from hardening too soon; whereas, if the Water be too hot, the Vessels shrivel, and the Blood coagulates. From Time to Time squeeze out the Fluids at the Apertures by which the Injection is to be made. The Maceration should always be in Proportion to the Age and Bulk of the Subject, and the Quantity of Blood observed in the Vessels: Particular Care must also be taken, to make the Subject, or Part, perfectly warm throughout, and to press it, with the Hands, till no more Blood can be forced away.

All Things being thus prepared, choose a Pipe a little smaller than the Diameter of the Vessel, and introduce it at an Incision made in its Side, and then, with a waxed Thread, secure it from slipping out.

If there have been any large Vessels cut, which communicated with those you intend to inject; or if there are any others, from the same Trunk, which you do not choose to fill; let them be carefully tied, which will save the Injection, and make the Operation succeed the better. When this is done, warm both the Injections, stirring them all the While: The Oil of Turpentine should be no warmer than what you can bear your Finger in; the other Injection must be near boiling. The Syringe should be made very hot, by drawing boiling Water into it; and the Pipe within the Vessel may be heated with a Sponge dipped in boiling Water. A coarse Cloth must be wrapped round the Syringe; otherwise you will not be able to hold it. Things being thus far prepared, fill the Syringe with the finer Injection, and then introduce



duce the Pipe of the Syringe into that of the Vessel, and press them together, holding this last Pipe firm with the left Hand, and griping the Syringe with the other; then pressing your Breast against the Sucker, gently force it down. The Injection should be thrown in slowly, and with no great Force, and proportioned to the Length and Bulk of the Part, and the Strength of the Vessels.

When you have pushed the Sucker so far that you are sensible of a Resistance that would require a considerable Force to overcome; draw it a little back, in order to empty the nearest large Vessels; then take the Syringe away, and force out the fine Injection, and immediately fill it with the coarser, which must be thrown into the Vessels quickly and forcibly; having always Regard to the Strength of the Vessels, &c. Continue to force in the Injection till you feel a full Stop, when you must desist; otherwise the Vessels will burst, and the Whole, or Part, of the Preparation, be spoiled. You must always remember to keep the Syringe in the Pipe which is fastened to the Vessel, till the Injection is grown cold; when there is no Danger of its running out.

This Way I have injected the cortical Part of the Brain, Tunica Choroïdes and Vasculosa of the Eye, Periosteum of the Bones of the Ear, Vessels of the Teeth, and Tunica Villosa of the Intestines.

The Difficulties of preparing and preserving the Parts of animal Bodies for anatomical Uses, are apt to discourage young Beginners from prosecuting this useful Art with due Application: To facilitate their Labours, which may possibly contribute to the Improvement of Anatomy, I shall lay down the Methods which I have found the most successful.

## clxxii The Art of preparing and

The chief Preparation of the Bones is, to make them white, and this may be done by macerating them in cold Water (which should be often changed), and then putting them to dry in the Sun; taking particular Care not to let them lie too long in the Water, lest the most spongy Parts be destroyed, or the Epiphyses separated. If the Bones are of a young Subject, and if they are suffered to dry, before the Blood is entirely taken away; they will never be white.

The Bones of young Animals, as they have less Oil, will be whiter than those of old ones, and will not so soon turn yellow.

The Bones of Fœtuses should be frequently taken out of the Water, and the Periosteum suffered to remain on at the Epiphyses.

Cartilages are prepared as the Bones are, but must be brought to, and kept in, their proper Shape, by Strings, Weights, and the like, whilst they are drying.

The Muscles are to be laid in the Posture which they are intended to be preserved in, and, as they are drying, pressed into their natural Shape.

When you have injected the Blood-Vessels, according to the Method laid down in the following Article, macerate the Part in cold Water, till the Blood is all extracted; then squeeze all the Water out of it, and hang it up to dry a little in the Air, before you put it into the Spirit in which it is to be preserved.

But there is still farther Art requisite to shew very minute Vessels, which is as follows; viz. Put the Part into Water, and there let it remain till the involving Membrane is raised from it, which you must separate, and remove quite away, suffering the other Part to lie in the Water, till the Fibres are dissolved, which may be known by shaking the Part in the Water, which washes the

corrupted Particles off by Degrees; and, at last, the small Vessels will appear distinct, floating in the Water: Then take the Preparation out, drain all the Water from it, and suspend it in the Middle of a Glass (which is to be filled with the preserving Liquor) by a Thread or Hair.

I could never divide Nerves into their very small Filaments, after they were involved in the Dura Mater; but, before, it is easily done.

Those that make up the Cauda Equina, are best for this Purpose: Cut one of these Cords thro', where it comes from the Medulla Spinalis, and is about to enter the Dura Mater; pass a Horse Hair thro' one End of it, and suspend it in Water for some Time; when it is well macerated, raise it to the Side of the Bason, and draw a small Needle lightly along it; continue this Operation, till, upon twirling the Nerve in the Water, you see it expanded into a fine Web of Fibres; it is then fit to be put into the Spirit. If the Blood-Vessels are first injected, tie the Hair to the End nearest the Dura Mater, that the Trunk of the Nerve and Artery may be seen together.

The Cauda Equina, thus prepared, appears very beautiful, the injected Vessels running almost upon each Filament of the Nerve.

When a fine Membrane, such as the Pleura, is to be preserved, in order to shew the Arteries, after Injection; as much of the cellular Membrane should be saved as can be, without spoiling the Transparency: For when it is wholly removed, few continued Ramifications are to be seen. When there is but little Fat in the Cells, the Membranes, if left, cannot be easily discerned; and, if there is much Fat, it must be pressed out as clean as possible, and the Part well macerated.

In Membranes, which are to be preserved wet, the Vessels will appear much plainer, if they are  
first

## clxxiv The Art of preparing and

first dried, and afterwards put into the Liquor. To do this, extend them, with Pins, on a smooth Board; and, when they are dry, cut off the doubled Edges, and other Inequalities, with Scissars. RUYSCH separated the Cuticula and Corpus Reticulare from the Skin by stretching the Integuments on a Board, and then dipping them into scalding Water; by which the Cuticula and Corpus Reticulare were loosened, and then easily separated from the Skin by the Handle of a dissecting Knife; as may be, also, the Corpus Reticulare from the Cuticula: Afterwards, they may either be kept dry, or in Spirit of Wine.

The Cuticula of the Hand or Foot may be taken off entire, after it is loosened by Putrefaction; and this Method is preferable to the former.

The Membrana Cellularis cannot be kept inflated, unless it has little or no Fat. The best Part, for a Preparation of this Kind, is the Scrotum; which, by Inflation, may be changed into fine membranous Cells. CAR. STEPHANUS says, that the cellular Membrane in any other Part appears muscular when the Fat is gone.

These Observations will serve as an Apology for some Anatomists, who reckon a Tunica Caricosa among the common Integuments of the Body.

To preserve the Dura Mater in its natural Situation, you must first saw the Cranium from the Nose to the Occiput perpendicularly, and afterwards by an horizontal Section, terminating at the Extremities of the former; remove a great Share of one Side of the Cranium, then open the Dura Mater by an Incision in the Form of a T, clear the Head of all the Contents, and preserve it in Spirit of Wine, or dry it in the Air, taking Care to keep the Dura Mater from shrivelling.

If

## preserving Human Bodies, &c. clxxv

If the Head of a Fœtus is to be thus dried, the Membranes between the Bones must be kept from contracting, by putting little Sticks, of a proper Length, into the Cranium, so as to prevent the Bones from approaching each other. The Processes of the Pia Mater are easily separated entire with it, when this Membrane (which frequently happens) is much thickened; and, even in a natural State, large Pieces of it, with its Processes, may be separated, after proper Maceration. When it is quite freed from Water, put it into the Spirit of Wine, taking Care to keep it properly extended.

Before you can prepare the Eye so as to demonstrate all its Parts, you must coagulate the crystalline and vitreous Humours, by putting them into a convenient Liquor; after this, macerate it, for some Time, in Water, and then you will easily separate the choroïd Tunic, and also Ruyssch's. The Glands and Ducts of the Palpebræ are better seen after the Arteries are injected, and the Liquors coagulated, than in a fresh Subject.

By macerating the Ear in Water, the Membrane which lines the Meatus Auditorius Externus, and forms the external Lamella of the Membrana Tympani, seems to be composed of this Cuticula, and the Membrane which lines the Tympanum, joined by a cellular Substance in which the larger Branches of the Vessels are distributed.

The Cuticula of the Lips is easily taken off after Maceration, which much improves the villous Appearance, when the Lips are afterwards put into Spirit of Wine.

The villous Substance of the Tongue is made quite red by a proper Injection, and a Membrane analogous to the Cuticula separates from it by Maceration; and, indeed, the Lips, Tongue, Oesophagus, Stomach, and Intestines, seem to be

## clxxvi The Art of preparing and

covered with this Sort of Cuticula which is fastened to the muscular Part by a cellular Substance that contains the Nerves, Blood-Vessels, Glands, &c. this forms Valves, or Rugæ, where it is thick and loose; but looks like a fine Membrane where it is thin and stretched.

There are no Parts of the Body so difficult to have a good Idea of, as those subservient to Deglutition; as neither a recent Body, nor a wet Preparation, can shew them tolerably exact. The best Way is, to shew the larger Parts in a dry Preparation, which requires great Patience to execute well. For, after all the Muscles are neatly dissected, they must be cut off from the surrounding Parts, and removed, together with the Tongue, Os Hyoides, Fauces, Velum Palati, Uvula, Larynx, &c. and then placed and kept in their natural Situation, with Pins or Threads, orderly fastened to a Board: Then put a Cork into the lower Part of the Trachea, and tie that and the Oesophagus firmly together, and fill the Oesophagus, Trachea, &c. with Quicksilver; in which Condition hang the Whole up till the Parts are pretty firm, but not quite dry; when the Quicksilver should be poured out, and the Parts which are over-stretched should, by squeezing and pressing, be brought to their natural Situation; and such as are too much shrivelled pulled out, from Time to Time, to their natural Shape, till they are quite dry.

The hollow Viscera of the Thorax and Abdomen ought to have their Vessels first injected, and, when they are to be preserved dry, filled with a convenient Matter, to prevent their shriveling as they dry, and which afterwards may be easily removed.

The best Methods are, either blowing them up, or filling them with Quicksilver, or melted Wax:  
The

## preserving Human Bodies, &c. clxxvii

The last is only proper to shew the exterior Surface; in all other Cases, use either Air or Quicksilver. I prefer the first; for it stretches all Parts equally; but Quicksilver presses most on the depending Parts: Besides, the Intestines which are inflated dry in much less Time than those which are filled with Quicksilver; but if the Parts are such as will not retain the first, they must be prepared by the latter.

In preparing the Oesophagus, Stomach, Intestines, &c. you must make Use of Air; but in preparing the Pericardium, Uterus, &c. Mercury is necessary; as also in the Heart with its Blood-Vessels, and the Pelvis of the Kidney with the Ureter.

The Corpora Cavernosa and Vesiculæ Seminales retain both; but Mercury leaves a Tinge, which hinders a clear View of the Structure of the Parts; and it is also difficult to fill the Vesiculæ Seminales with it: For when it is poured into the Vas Deferens, it is liable to be stopped by the Moisture of this Tube; and, when it is not, it often forces its Way into the Urethra, and never mounts into the Vesicula till the Urethra is quite filled: Whereas the Air, when gently blowed in, easily rises into the Vesicula, as it has not Force enough to open the Orifice in the Urethra.

The Lungs or Spleen will seldom retain Air; nor will the Glans of the Penis always do it: Therefore, for these Parts, we generally make Use of Quicksilver. But this does considerable Damage to the Lungs and Glans, as the Cells are smaller than those of the Spleen.

When we have once fixed upon our Liquors, Care should be taken to clear the Parts, intended to be filled, of their Contents, and to secure all the Openings except that through which we intend to pour the Liquors. This Passage should be such

## clxxviii The Art of preparing and

as will best and soonest admit the Fluid into every Part of the Cavity you intend to fill, and which is easiest to be secured afterwards. The Place proper for inflating the Intestines, Vesica Fellea, and Urinaria, every Body knows. The Heart and large Arteries are easily filled thro' the Vena Cava, or pulmonary Veins; the Lungs by the Trachea Arteria; the Kidney by the Ureter; the Spleen by the Capsula Atrabilaris, and the Corpora Cavernosa Penis by their proper Veins.

For inflating any of the Vessels, a Pipe with a Notch at the End, with a Stop-cock above it, is most convenient. Introduce the small End into the Opening, and with a waxed Thread tie the Vessel to the Pipe exactly over the Notch, which will prevent its slipping: When you have sufficiently inflated the Part, turn the Cock, and leave it to dry. If you make Use of a common Blow-pipe, you must get an Assistant to make a Ligature on the Vessel below the Pipe when the Part is sufficiently distended. If Quicksilver is used, the Passage thro' which it is poured must be higher than the rest of the Preparation; and when the Passage is narrow, a small Glass Funnel or Pipe is convenient, which must be long, where the Weight of a Column of Quicksilver is necessary to fill the minute Vessels.

If the Part will allow it, this Passage should be tied firmly, or else kept always uppermost till the Preparation be quite dried. When a large Quantity of Quicksilver is poured into a Part of a tender Texture, the upper Part of it should be suspended by Threads and Hooks, and the inferior Part supported by a small Net spread under it.

The Directions before given are sufficient for preserving the greatest Part of the Viscera; but the Lungs and Spleen require more Care, as Quick-  
silver



silver or Air will easily escape through their Membranes.

These Parts should be taken from such Animals as have the exterior Membrane of these Viscera thick and strong: After they are distended, dry them in the Sun, or before a moderate Fire, taking Care, if they subside, to inflate them a-new. As soon as the Surface is dry, cover them with Turpentine Varnish, which will prevent the Air from escaping, and dry them thoroughly with all possible Expedition. When the human Spleen has been thus distended and dried, you will find it composed of Cells, communicating with each other, with several Branches of an Artery spread upon the Sides of them, if the Arteries be first injected. If the Lungs, thus prepared, are cut, the Vesicles appear to be Polygons, for the most part irregular Squares and Pentagons; and one might conclude, that they are more so in a living Animal; for the exterior Membrane is of a Texture stronger than the Vesicles, and will keep them from being extended so much as they are capable; and therefore they must press against each other, and form a Figure of as many Angles and Sides, as there are contiguous Vesicles; and then the Thorax does not admit the Lungs to be distended as far as the exterior Membrane will allow: Consequently, the Vesicles must be more compressed, and the Sides streightened; in Respiration, than when they are distended after they are taken out of the Body.

These Considerations, and the plain polygonous Form of the Cells in the Lungs of Serpents, Frogs, &c. make it surprising that the Vesicles of more complicated Lungs should be taken to be spherical, or any Figure whose transverse Section is circular.

## clxxviii The Art of preparing and

as will best and soonest admit the Fluid into every Part of the Cavity you intend to fill, and which is easiest to be secured afterwards. The Place proper for inflating the Intestines, Vesica Fellea, and Urinaria, every Body knows. The Heart and large Arteries are easily filled thro' the Vena Cava, or pulmonary Veins; the Lungs by the Trachea Arteria; the Kidney by the Ureter; the Spleen by the Capsula Atrabilaris, and the Corpora Cavernosa Penis by their proper Veins.

For inflating any of the Vessels, a Pipe with a Notch at the End, with a Stop-cock above it, is most convenient. Introduce the small End into the Opening, and with a waxed Thread tie the Vessel to the Pipe exactly over the Notch, which will prevent its slipping: When you have sufficiently inflated the Part, turn the Cock, and leave it to dry. If you make Use of a common Blow-pipe, you must get an Assistant to make a Ligature on the Vessel below the Pipe when the Part is sufficiently distended. If Quicksilver is used, the Passage thro' which it is poured must be higher than the rest of the Preparation; and when the Passage is narrow, a small Glass Funnel or Pipe is convenient, which must be long, where the Weight of a Column of Quicksilver is necessary to fill the minute Vessels.

If the Part will allow it, this Passage should be tied firmly, or else kept always uppermost till the Preparation be quite dried. When a large Quantity of Quicksilver is poured into a Part of a tender Texture, the upper Part of it should be suspended by Threads and Hooks, and the inferior Part supported by a small Net spread under it.

The Directions before given are sufficient for preserving the greatest Part of the Viscera; but the Lungs and Spleen require more Care, as Quick-  
silver

silver or Air will easily escape through their Membranes.

These Parts should be taken from such Animals as have the exterior Membrane of these Viscera thick and strong: After they are distended, dry them in the Sun, or before a moderate Fire, taking Care, if they subside, to inflate them a-new. As soon as the Surface is dry, cover them with Turpentine Varnish, which will prevent the Air from escaping, and dry them thoroughly with all possible Expedition. When the human Spleen has been thus distended and dried, you will find it composed of Cells, communicating with each other, with several Branches of an Artery spread upon the Sides of them, if the Arteries be first injected. If the Lungs, thus prepared, are cut, the Vesicles appear to be Polygons, for the most part irregular Squares and Pentagons; and one might conclude, that they are more so in a living Animal; for the exterior Membrane is of a Texture stronger than the Vesicles, and will keep them from being extended so much as they are capable; and therefore they must press against each other, and form a Figure of as many Angles and Sides, as there are contiguous Vesicles; and then the Thorax does not admit the Lungs to be distended as far as the exterior Membrane will allow: Consequently, the Vesicles must be more compressed, and the Sides streightened; in Respiration, than when they are distended after they are taken out of the Body.

These Considerations, and the plain polygonous Form of the Cells in the Lungs of Serpents, Frogs, &c. make it surprising that the Vesicles of more complicated Lungs should be taken to be spherical, or any Figure whose transverse Section is circular.

## clxxx The Art of preparing and

The Manner of preserving Preparations, is either by drying them thoroughly in the Air, or putting them into proper Liquors. In drying Parts which are very thick, when the Weather is warm, you must take Care to prevent Putrefaction, Fly-blows, Insects, &c. from destroying them; which is easily done, by soaking the Part in a Solution of corrosive Sublimate in Spirit of Wine, made in the following Proportion; viz. Spirit of Wine, one Pound; Mercury Sublimate, two Drachms. The Part should be moistened with this Liquor as it dries. By this Method, the Body of a Child may be safe kept, even in the Summer.

As dried Preparations are apt to crack, and moulder away, in keeping; you should cover the Surface with a thick Varnish, and repeat this as often as there is Occasion. Though several Parts prepared dry are useful, yet several others must be so managed, as to be always flexible, and nearer a natural State. The Difficulty has been, to find a proper Liquor for this Purpose. The best which I know, is a well-rectified colourless Spirit of Wine; to which I add a small Quantity of Spirit of Vitriol, or Nitre.

When these are properly mixed, they neither change their Colour, nor the Consistence of the Parts, except where there are serous or mucous Liquors contained in them. Even the Brain of a young Child, in this Mixture, grows so firm, as to admit of gentle Handling; as do, also, the vitreous and crystalline Humours, &c. of the Eye: The Liquor of the sebaceous Glands, and the Semen, are coagulated by this spirituous Mixture. It heightens the red Colour of the Injections of the Blood-Vessels, so that, after the Part has been in it a little Time, several Vessels appear, which were before invisible.

If

## preserving Human Bodies, &c. clxxxi

If you compare these Effects with what Ruysch has said of his Balsam, you will find, that the Liquor before mentioned comes very near to it.

The Proportion of the two Spirits must be changed according to the Part prepared. For the Brain, and Humours of the Eye, you must put two Drachms of Spirit of Nitre to one Pound of Spirit of Wine: In preserving other Parts which are harder, thirty or forty Drops of the Acid will be sufficient: A large Quantity will make Bones flexible, and even dissolve them.

The Part, thus preserved, should be always kept covered with the Liquor: Therefore be very careful to stop the Mouth of the Glass with a waxed Cork, and a Bladder tied over it, to prevent the Evaporation of the Spirit; some of which (notwithstanding all this Care) will fly off: Therefore you must add fresh, as you see Occasion. When the Spirits change to a dark Tincture, which will sometimes happen, pour them off, and put fresh in their Room, but with somewhat less acid than at first.

As for the Glasses which contain your Preparations, they should be of the finest Sort, and pretty thick; for through such you will see the Parts very distinct, and of a true Colour: And the Object will be so magnified, as to shew Vessels in the Glass, which out of it were not to be seen.

As the Glass, when filled with the Liquor, has a certain Focus, it is necessary to keep the Preparation at a proper Distance from the Sides of it; which is easily done, by little Sticks suitably placed, or by suspending it, with a Thread, in a proper Situation.

I shall finish these Directions with cautioning the Operator from putting his Fingers in this

## clxxxii The Art of preparing, &c.

Liquor oftener than is absolutely necessary; because it brings on a Numbness on the Skin, which makes the Fingers unfit for any nice Operation.

The best Remedy for this, which I know of, is, to wash them in Water mixed with a few Drops of Oil of Tartar per Deliquium.





A SYNOPSISICAL EXPOSITION of the Parts  
of the HUMAN BODY, as they are  
gradually met with in DISSECTION.



HE Dexterity of the Hand would be of very little Service, in dissecting the Human Body, if the Operator was ignorant of the Parts which he meets with in his Preparations.

They present themselves in so great a Number, that one would be at a Loss sometimes how to begin, if the Person has not had proper Instructions, to serve him as a Guide.

Books are of very little Help ; because the most methodical Order, that is found in them, is always very remote from that the Author of Nature has kept, in the Disposition of an infinite Number of Pieces which are the Construction and Frame of a Machine that seems to be the most beautiful Work of the whole Creation.

It is for the Sake of those, whose Knowledge does not correspond with their Good-will, that the Perusal of this Introductory Discourse is intended. What it contains will guide them by the Hand, and let them know, at once, all the Parts that might stop them in their Dissections.

We have thought proper only to point them out ; because if one desired any farther Instructions, he might consult the Lecture, that describes them fuller. We shall not mention any of those Parts whose Affinity is not equivocal ; as those of

## clxxxiv A Synopsical Exposition.

the Brain, Eyes, Ears, Mouth, Organs of Generation, &c. because they have been comprehended in one sole Article; intending only to name those Parts, whose Situation, Use, and Nature, may throw him, that discovers them, into Errors and doubtful Ideas, which may be a Hindrance to his Progress.

We shall be obliged to begin our Exposition by the anterior Part of the Neck; because one ought to have prepared upon that Part many Nerves, Vessels, and Muscles, which we ought to observe in the Head. We should not be understood, if we followed another Course; and shall divide this Exposition into seven Articles.

The first will contain all the Parts that one meets in the anterior Part of the Neck; the second will treat of the Head; the third of the external Parts of the Trunk; the fourth of the Thorax; the fifth of the Abdomen; the sixth of the superior, and the seventh of the inferior Extremity.

I. THE NECK SEEN ANTERIORLY. A very large cutaneous Muscle is the first Part one discovers on it; after it is raised, we see, without any other Preparation, the external Jugular, which is commonly double: This Vein runs laterally on the Neck, to empty itself into the subclavian Vein; and is sustained by a very considerable Muscle, that goes obliquely from the Sternum towards the posterior Part of the Ear, called Mastoïdes.

We must consider, before we proceed any farther on the Neck, three solid Parts, to which may be referred the Situation of the greatest Part of those to be mentioned hereafter; viz. the Larynx, Trachea Arteria, and Os Hyoïdes.



## A Synopfical Exposition. clxxxv

The Trachea Arteria is a Canal composed of cartilaginous Segments, easily discovered in the anterior and inferior Part of the Neck: It is almost covered by the Muscles and Glands, as will be mentioned hereafter; but its cylindrical Figure and Solidity make it very plain to be seen.

The Larynx is situated upon the Trachea Arteria, and is the Origin of it: It is anteriorly formed of two cartilaginous Pieces; and the most considerable of the two, which is the superior one, is called the thyroïd, and the second the cricoïd Cartilages.

The Thyroïdes is very remarkable, by its Sally: It is commonly called the Apple of ADAM. The Cricoïdes is of an annular Figure, which serves as a Basis to the first. The Os Hyoïdes, situated above the Larynx, is invested with many Muscles that terminate on it: Its Solidity makes it very conspicuous; and one may, by feeling it, very plainly discover its Form and Extent externally.

The two Muscles situated upon the Trachea Arteria are called Sterno-hyoïdes, and Sterno-thyroïdes: The first, or external one, ascends to the Larynx, and is inserted at the Os Hyoïdes; the second, which is under the former, terminates to the thyroïd Cartilage.

If these Muscles be raised, two smaller are discovered upon the Larynx; of which, the superior is the Thyro-hyoïdæus, and the inferior has been called the anterior Dilatator. There is besides, on the Trachea Arteria, a very considerable Gland called Thyroïdes, which commonly forms but one single Mass, and is sometimes divided into two.

Next to the preceding Muscles is met a thin one, that goes obliquely from the Omoplata to the Os Hyoïdes: It runs behind the Mastoïdes and external Jugular, and ascends afterwards before  
the

## clxxxvi A Synopsical Exposition.

the internal Jugular and the other Parts it meets in its Way. It is what is commonly named Coraco-hyoïdes.

The first Thing we discover under the Chin, is the anterior Portion of the Digastricus; then, after having separated it from the inferior Maxilla, is seen a pretty large Muscle called Mylo-hyoïdæus, behind which is seen the Genio-hyoïdæus. After we have turned back upon the Larynx, it at once presents to our View several Parts; viz. 1. The maxillary Gland. 2. The sublingual. 3. The Genio-glossus. 4. The Hyo-glossus. 5. The Nerve of the ninth Pair. The Glands are all placed behind the inferior Margin of the inferior Maxilla, the maxillary Gland is placed near the Angle of that Bone, the sublingual is not far from the Chin, the Genio-glossus and its similar Gland are situated between the two Sublinguales, and the hyo-glossal Muscle, more considerable than the former; sustains the Nerve of the ninth Pair that runs thro' it.

After having separated the Mastoïdes from the Clavicula, and the Coraco-hyoïdæus from the Omoplata, we observe two very considerable Vessels situated by the Larynx and Trachea Arteria; viz. the external Jugular, and the Trunk of the carotid; easily distinguished by their Colour and Substance.

The Jugular receives, near the Superficies of the Larynx, a very considerable Vein, which comes from the Concourse of those that run from the Larynx, Tongue, Face, &c. the Trunk of the internal Jugular passes afterwards behind the posterior Portion of the digastricus Muscle, between the internal Carotid and the Divisions of the external. We meet in that Place, I mean behind the posterior Portion of the Digastricus, a considerable Nerve that penetrates the posterior Side  
of

## A Synopfical Exposition. clxxxvii

of the Mastoïdes : It is called the spinal or accessory Nerve of WILLIS.

At the superior Part of the Larynx is seen the Division of the carotid Artery into external and internal : The internal is carried, by the Side of the Jugular, as far as the Basis of the Cranium, and is lost at the Distance of an Inch of that Division ; the external, before it arrives at the End of the Basis of the Maxilla, gives Rise to five pretty considerable Vessels ; viz. 1. The Larynx, which is not remote from the Division of the Carotid. 2. The Sublingualis that runs thro' the hyo-gloss Muscle. 3. The external Maxillary that passes behind the digastric Muscle, Sternohyoïdæus, Nerve of the ninth Pair, and runs thro' the maxillary Gland to ascend to the Maxilla, where we shall again take Notice of it hereafter. These two last Arteries arise from the same Trunk. 4. The Occipital, which is external, contrary to the three first that are towards the Larynx : It passes behind the eighth Pair of Nerves and Digastricus before the external Jugular, to be carried towards the Occipital, in insinuating itself under the superior Heads of the Mastoïdes, Splenius, and Longissimus Dorsi. 5. The Stylo-mastoïdæus, that arises sometimes from the occipital Trunk. Behind the Digastricus, known by its middle Tendon, is seen a thinner Muscle that goes towards the Os Hyoïdes, called Stylo-hyoïdes ; under this last one perceives always, upon the Divisions of the external Carotid, a pretty considerable Nerve, that runs almost parallel with this Muscle ; it is that of the ninth Pair which we have already mentioned. The common Trunk of the Carotids invests all along the anterior Part of the Neck, two very considerable Nerves, the Intercoastal, and Par Vagum. The first, which is internal, increases in Bigness above the Division of  
the

## clxxxviii A Synopsical Exposition.

the Carotid, and forms, from that Place to the Basis of the Cranium, a very conspicuous elongated Tumor, called the superior cervical Ganglion; the Nerve of the vagal Pair is a whiter Cord, and has more Solidity: If one separates inferiorly the Trunk of the internal Jugular, there is seen, on the anterior Side of the first Portion of the Scalenus, a pretty considerable Nerve, called Diaphragmatic. There appears afterwards many Muscles that arise from the Vertebrae of the Neck: The most anterior ones are, the Rectus Major, Capitis Anterior, and Longus Colli; the first, which is external, wraps over a Part of the other.

In the inferior Parts of the Neck, and behind the Clavicula, the two anterior Portions of the Scalenus are very remarkable: You may easily discover their superior Heads and Insertions, if the Anterior Major be removed a little, and you raise it. Behind the superior Part of the Scalenus is found another very considerable Muscle; it is what is commonly called Elevator Omoplatæ, and rises from the transverse Apophyses of the superior Vertebrae of the Neck. We must free a little and raise the Scalenus, to have a full View of them. Above the transverse Apophysis of the first cervical Vertebra, where ends the superior Portion of the Elevator, is seen a very short Muscle, called Rectus Lateralis; and behind the Elevator a Portion of the Splenius is seen, which terminates on that Side towards the mastoid Apophysis, and to the transverse of the first Vertebra.

Besides the Nerves already named, we meet with a great many more that arise from the Medulla Spinalis between the cervical Vertebrae; they are the Nerves called Occipitales and Cervicales. The first give a remarkable Branch under the internal Margin of the Rectus Lateralis, soon after which they

## A Synopfical Exposition. clxxxix

they meet the Par Vagum and Intercoftal, with both which they communicate; they alfo fend off a Filament that descends before the tranfverfe Apophyfis of the firft Vertebra, and communicates with the firft cervical Pair.

Afterwards the Nerve of the firft cervical Pair is perceived, a very remarkable Cord, that arifes posteriorly, and paffes under the internal Margin of the firft Head of the Elevator Omoplata; then the fecond, third, and fourth, cervical Pair appear, and in that Order: You need only pull afide the Fibres of the Scalenus to have a full View of them. For the others, we muft destroy the fuperior Head of the firft Portion of the Scalenus, in order to fhew them, by putting them back upon the Clavicula. Then is diftinctly feen the four laft cervical Pairs that form a fingle Plane, and re-unite, at the Difftance of an Inch, to form the Plexus, whence the brachial Nerves arife; and may even fee, under the laft cervical Pair, the Nerve of the Primi Dorsalis that connects with it. Under this nervous Plexus a great Artery is feen that has almoft the fame Direction; it is the fub-clavian.

2. THE HEAD. Its Parts are reduced to a fmall Number, if we omit the Brain, Eyes, Ears, Noſe, and many internal Parts of the Mouth.

There is ſcarce any Place but the Face where one meets with Muſcles, Glands, Nerves, and Veſſels, that may create ſome doubtful Ideas. We ſhall confine ourſelves, then, to conſider it relating to all its Parts that we ſhall name in the Order they will preſent themſelves.

THE FACE. The greateſt Part of the Muſcles of the Face are cutaneous, therefore the Skin muſt be raiſed with a great deal of Care, ſo as not to deſtroy the Muſcles. The Forehead is occupied  
by

## cxc A Synopſical Expoſition.

by the anterior Portion of the Ciliares Majores; the Ciliares Minores are placed next to the Root of the Noſe, under the Eye-brow; the Orbicularis Palpebrarum is a large muſculous Spanſion which ſurrounds thoſe Productions of the Skin, or that ſuſtains them; upon the lateral Side of the Noſe is ſeen the Obliquus Descendens Muſcle; the Inciſive is not far from the inferior Part of the Noſe; the Angulare Arteria runs upon that Muſcle. If we raiſe the inferior Extremity of the Obliquus Descendens, and the Inciſorius, we diſcover the Myrtiformis; the Caninus lies under the Inciſive, towards the Lips; the Orbicularis Labiarum is that muſculous Maſs which forms the Thickneſs of them: The Zygomatic, which is often double, goes obliquely from the temporal Arch to the Angle of the Mouth. Under the former is perceived; between the Maxilla, a pretty large Muſcle called Buccinator; it is the deepeſt Muſcle belonging to the Mouth: From the Buccinator, towards the Chin, we meet, 1. The Triangulares. 2. The ſuperior Extremity of the Muſcle lying on the anterior Side of the Neck. 3. The Muſcle of the Chin placed under the inferior Lip. Upon the lateral Part of the Cranium, above the temporal Curvature, is ſituated a very conſiderable Muſcle called Crotaphites, that ſuſtains the temporal Artery; above the cartilaginous Part of the external Ear lies its ſuperior Muſcle; the Space between the temporal Arch, to the Portion of the Baſis of the Jaw Bone anſwering to it, is occupied by the Maſſeter. Between this laſt and the Ear is ſituated a very conſiderable Gland, which is the parotid; its Duct goes to the Maſſeter, and tranſverſly to the Buccinator, which it runs through: Between the maſſeter and triangular Muſcle we find the internal maxillary Artery. If we raiſe the maſſeter from  
the

the zygomatic Arch, we may diſcover, by the Opening that is between the coronoid of the Maxilla and its Head, the ſmall Pterygoïdæus and the Tendon of the Crotaphites: The Pterygoïdæus Major, which occupies the interior Side of the Maxilla that is parallel to it, covers the Maſſeter. To proceed any farther, we are obliged to ſaw off the inferior Maxilla near the Chin, deſtroy the Head of the Crotaphites, and alſo that of the Pterygoïdæus Major, that we may pull back that Portion of the Maxilla next to the Ear: Then is ſeen, very diſtinctly, the Branch of the fifth Pair, which inſinuates itſelf into the Sinus of the inferior Maxilla; afterwards the Pterygoïdæus Minor is plainly perceived: We muſt afterwards divide this from the Os Sphenoïdes, and do it with a great deal of Care, for Fear of hurting the Trunk of the maxillary Artery that runs thro' its Baſis, and to the Diviſions of the internal maxillary Nerve. We ought afterwards to obſerve the internal maxillary Artery that goes into it, with the Nerve juſt mentioned, which muſt both be cut at their Entry into the Maxilla, that we may carry off all that Portion of the Maxilla in deſtroying the Ligamentum Capſulare of the Articulation, where we perceive an inter-articular Cartilage, of which mention has been already made: Then we ſee that conſiderable Branch of the external Carotid which we have named maxillary, from which ariſe four Arteries; the internal maxillary, ſpinal, orbital, and naſal. The firſt is ſeen before you take off the inferior Maxilla; the ſecond is ſeen behind the nervous Cord that belongs to it; then the two laſt are eaſily conducted to the inferior Orbital or Opening, and to the ſpheno-palatin Foramen that receives them. We ſee again, in the Cavity that lodged the Pterygoïdæus Minor, the Branches of the inferior maxillary Nerve. The

## cxcii A Synopsical Exposition.

two most considerable are, that which embraces the Pterygoïdæus Major, destined for the Tongue; and the Nerve of the Maxilla. We must observe, that the maxillary Artery passes, after having given Rise to the internal Maxillary and spinal, between those two Nerves: The other Branches of the inferior maxillary Nerve expand themselves, like a Web, upon the adjacent Parts. There is a very considerable one that runs behind the Origin of the Maxillary; it penetrates the parotid, and goes upon the temporal Artery. The inferior Extremity of the Cotaphites receives one, less remarkable than the former ones; the others accompany the Divisions of the orbital and nasal.

If we pull back the Pterygoïdæus Major in the Cavity that was in the Minor, is seen, behind the Basis of the first, two Muscles of the palatin Arch, whose most anterior is the concave Muscle, very remarkable by its Tendon, that the Hook of the external Wing of the pterygoïd Apophysis sustains. The right one is situated posteriorly, tho' it appears to be the first. Behind the carotid Trunk one ought to consider two Muscles that arise from the styloïd Apophysis; the anterior is the Stylo-glossus, the posterior is the Stylo-pharyngæus: Therefore there are two Muscles in that Part, which have the same Direction; viz.

1. The Digastricus, or its posterior Portion that goes towards the Os Hyoides.
2. The Stylo-hyoides, that commonly runs with the former.
3. The Stylo-glossus, that goes towards the Tongue.
4. The Stylo-pharyngæus, that is, the deepest.

Under the Stylo-pharyngæus lies the Nerve of the ninth Pair that passes before the Intercoastal, Par Vagum, and internal Carotid; then may be seen the Fibres of the posterior Plane of the Pharynx, the Continuance of those Fibres with the middle ones of the Buccinator; we again see,



see, in putting the Pharynx aside, the Rectus Major, and anterior Capitis, in all its Extent. If we divide it from the Basis of the Cranium, you will directly see the Rectus Minor anterior. We have mentioned the Rectus Lateralis before.

**THE HEAD SEEN POSTERIORLY.** The Parts we meet with posteriorly upon the osseous Cavity are, after the Teguments, 1. The aponeurotic Membrane, that covers not only a great Part of the Cranium, but also the posterior Part of the Neck. 2. The Ciliares Majores; and, next to their occipital Fibres, the posterior Muscle of the Ear. 3. The Pericranium. There are also many Muscles of the Omoplatea, Back, and Head, that have their Origin in the Occiput; as we shall point them out.

3. **THE TRUNK.** We shall comprehend, under this Head, all that is fixed upon the anterior Part and Side of the Thorax and the Clavicle, with what forms the musculous Circumference of the Abdomen from the cartilaginous Margin of the Frame of the Thorax to the Bones of the Pelvis. We shall afterwards examine the Back, and posterior Part of the Neck that we cannot separate.

**THE TRUNK SEEN ANTERIORLY.** The Pectoralis Major is a Muscle that belongs to the Arm, and occupies a great Part of the anterior Side of the Thorax; it forms a Plane continued with the Deltoïdes, that surrounds the superior Part of the Os Humeri, and appears with the former without any other Preparation. One sees under the Pectoralis Major, upon the lateral Part of the Thorax, a pretty considerable Portion of the Serratus Major Anticus, and then the interior Margin of the Latissimus Dorsi that goes from under the Arm to the Offa Ilei. The remaining Part of the Space that we ought to consider, is occupied by the Ob-

## cxci A Synoptical Exposition.

liquus Major, a Muscle belonging to the Abdomen, and terminates its Circumference externally. Its superior Extremity covers inferiorly a considerable Part of the Thorax: It cannot be seen, in all its Extent, when we consider only the external Side of the Trunk, its posterior Portion extending itself to the Extensors of the Back. One ought to consider, in the inferior Part of the Aponeurosis Obliqui Majoris, the Annulus that gives a Passage to the spermatic Nerve, inclosed by the cremaster Muscle, and under it the inguinal Ligament that extends from the anterior and superior Spines of the Pelvis to the most acute and extreme Part of the Os Pubis.

Those are all the Parts that appear without Preparation, after having raised the Teguments: However, I think it necessary to observe, that we often meet, upon the Clavicles and the superior Part of the Pectoralis Major, a Portion of the cutaneous Muscle called *Platysma-myoides*.

Behind the Pectoralis Major is met with the Vessels that distribute themselves into all its internal Side; viz. the thoracic superior Artery, with its Vein, accompanied with some little Nerves. These Vessels cannot be well seen till the Pectoralis Major is pulled back, and also the anterior Portion of the *Deltoïdes*.

There appears then two other smaller Muscles, called the *Subclavian* and *Pectoralis Minor*. The first is sometimes wanting: When it is there, its Situation under the *Clavicula* makes it well known, relating to the *Pectoralis Minor*. It is placed immediately behind the Major, at a small Distance from the cartilaginous Portion of the Ribs: We discover, besides, a Portion of the *Serratus Major* that covers, with the *Obliquus Major*, all the lateral Side of the Thorax. One may observe the two Planes of the intercostal Muscles: The internal

## A Synoptical Exposition. cxcv

ternal appears between the cartilaginous Portion of the Ribs, the external being wanted in that Part: This is to be seen between the osseous Ribs, the Direction of the Fibres that compose them making them very conspicuous. If the Obliquus Major be raised, a pretty considerable Portion of the Frame of the Thorax is discovered, and also the Obliquus Minor that fills pretty exactly the Space between the Margin of that Frame and that of the Pelvis. The transverse is situated behind the Obliquus Minor; then follows the Peritonæum.

What we have said, ought to be understood of the lateral Part of the Abdomen; for in its middle Part we may see, on both Sides, two other Muscles, which are, the Recti and Pyramidales: They are both placed between the thin Laminæ of the Aponeurosis of the Obliquus Minor. The Rectus extends itself from the Sternum to the Os Pubis; the Pyramidalis is only a few Inches long: They terminate in ascending to the Linea Alba.

If we go thro' the Rectus, we shall discover, in its internal Side, an Artery that has its Direction towards the Sternum; it is the epigastric, with its Vein: These Vessels pass behind the spermatic Nerve, that meets them near their Origin to go towards the interior Side of the Muscle just mentioned.

THE TRUNK SEEN POSTERIORLY. After having raised the Teguments, we see only two large Muscles, which, from the Occiput to the Os Innomatum, or Pelvis, cover on each Side all the Back, and also all the posterior Part of the Neck that we shall mention in this Article: The superior is called Trapezius, and the inferior Latissimus Dorsi. The first occupies all the Neck, a Part of the Omoplatæ and the Clavicula, and extends itself to the last spinal Vertebra; the second covers

## cxcvi A Synopfical Exposition.

all that Part from the Omoplata ; viz. the inferior and lateral Part of the Spine quite to the Os Sacrum and Os Ilei. After the Trapezius, between the Basis of the Omoplata and spinal Apophyses of the Vertebrae, we discover the Rhomboïdes ; and, behind this last Muscle, the superior and inferior Serratus Minor.

After having raised all those Muscles of the spinal Apophysis, and having put them back ; we discover, 1. The Elevator Scapula situated upon the lateral Part of the Neck, terminating in the superior Angle of that Bone. 2. The Splenius, extending itself from the Apophysis of the Spine of the superior Vertebra of the Back to the Os Occipitis ; this last being raised, we discover the Complexus, which has almost the same Extent, tho' in a contrary Direction.

The superior Part of the Complexus hides four small Muscles, situated between the spinal Apophysis of the second Vertebra and the Os Occipitis. The most considerable are, the Obliquus Superior and Inferior ; the others are, the Rectus Major and Minor Posterior : Then there remains only, upon the Back, the three Extensores Majores, ranged, in a parallel Order, Side by Side. The most external is the Costa Cervicalis, extending from the Pelvis to the transverse Apophyses of the cervical Vertebrae. The next that follows is the Longissimus : It has almost the same Origin, and ascends to the Os Occipitis. The third is the Obliquus Spinalis : It touches all the spinal Apophyses of the lumbal Vertebrae and the Spine, to the second cervical Vertebra. We discover, in raising the Complexus, a pretty considerable Nerve that penetrates thro' it ; it is a Branch of the first cervical Pair. We easily discover the Trunk of that Nerve, if we destroy the Obliquus Inferior, and afterwards separate from the Os Occipitis the Ob-

## A Synopfical Exposition. cxcvii

Obliquus Superior; then will be seen, without any other Preparation, behind this Muscle, the Trunk of the Infra Occipitalis Nerve, and a Portion of the vertebral Artery.

4. THE THORAX. The anterior Side of it being deprived of the Pectoralis Major and Minor, Latissimus Dorsi, Obliquus Major, and the Rectus Muscles; we then free the Sternum and Ribs, with their cartilaginous Portion, and the intercostal Muscles, which occupy, very exactly, all the Space between the Ribs.

We have said, that we could see, without any Preparation, the two Planes of intercostal Fibres; that the external Plane terminated at one or two Inches from the Cartilage that makes the Complement of the Ribs: Therefore one may observe a very considerable Portion of the internal Plane, which is easily distinguished from the other by the Direction of its Fibres.

After having cut the Ribs as already taught, the Sternum is kept in its Place; then is seen, on both Sides, the Lungs (which fill very exactly that double Space) inclosed in the Cavity of the Thorax: It is carried inferiorly upon the transverse musculous Margin named the Diaphragm. If we raise the Sternum, in its internal Surface are seen, 1. The interior mammillary Vessels that run under the cartilaginous Extremity of the Ribs. 2. The Sterno-costa Muscles, which are, however, not well perceived till we pull the Sternum back. 3. The Margin that separates the Cavity of the Thorax in two, called the Mediastæum. This Margin, which is pretty regular vertically superior, loses that Direction in its inferior Part, where the two Membranes that compose it widen themselves, to leave a suitable Space for the Heart and its Pericardium.

## cxcviii A Synopfical Exposition.

After having taken away the Sternum, in keeping the Mediastinum as sound as possible, one may perceive, by pulling a little aside the Lobes of the Lungs, 1. The diaphragmatic Nerve and Vein, which run all along the Mediastinum and Pericardium. 2. The mediastic and pericardic Veins, that equally appear without any Preparation. It must be observed, that we only meet the diaphragmatic Vein on the left Side; it is the superior we mean.

The Membrane that covers the Nerve and Vessels we have just mentioned; and that which seems to form the Mediastæum, belongs to the Pleura. It is observed, after having removed it, that the Capsula surrounds the Heart by the Name of Pericardium. It has more Solidity than the Pleura; and, in opening it, we perceive the Heart in all its Extent, with the Principle or Origin of the great Vessels: That Organ is situated obliquely upon the aponeurotic Part of the Diaphragm that seems to be confounded here with the Pericardium.

The Basis of the Heart gives Origin to two great Arteries, known by their Solidity and Whiteness. The right one is the Aorta; the left the pulmonary Artery. On the right of the Aorta we see the Vena Cava, and the anterior Auricle of the Heart. If we turn up this Organ, we see the posterior Auricle of the pulmonary Veins, which do not appear plain till they are well prepared.

We shall mention the Nerves, coronary Vessels, and other Parts of the Heart, hereafter.

On the internal Surface of the first Bone of the Sternum, we find, between the Lamellæ of the Mediastæum, a white Body void of Sensibility, except in the Fœtus; it is the Thymus; whose remarkable Vessels have the Names of Artery and thymic Vein. The left subclavian Vein that opens  
in

## A Synopfical Exposition. cxcix

in the superior Cava is immediately situated behind the Thymus.

When we raise the left Lobe of the Lungs, and pull it back to the right, there appears a great Cavity, which is that contained by it. It is covered by the Pleura, thro' which are distinctly seen the Nerves and Vessels we shall mention hereafter. If that Membrane be raised, we may distinguish much better all those Parts; the most considerable of which are, 1. The Aorta, which runs on the Body of the Vertebræ. 2. A Portion of its winding Part. 3. The subclavian Artery.

There is, before the Aorta, a pretty considerable Nerve called Par Vagum. It forms, under the Lungs, a remarkable Winding called the pulmonary Plexus: The Nerve of the Par Vagum meets, above the Curvature of the Aorta, the diaphragmatic Nerve just mentioned, with which they intersect, the diaphragmatic being the anterior one; and we may easily follow the Nerve of the Par Vagum quite to the Diaphragm. It throws itself, just before it arrives there, upon a very considerable musculous Duct, that runs, on the right of the Aorta, in the Middle of the Body of the Vertebræ, named Oesophagus.

If we disengage a little the Aorta below its Winding, by pulling it from the Lungs, we easily discover in the cellular Substance, which must be destroyed, a small Artery going to that Viscera; it is the bronchial Artery. We may prepare, with the same Facility, the Arteries of the Oesophagus, which are small Branches of the Aorta or the Intercostals that run to the Oesophagus, one commonly meets behind the Aorta a Vein more or less considerable that belongs to the Azygos. It commonly ascends upon the left subclavian Artery, to throw itself in the subclavian Vein on the same Side.

## cc      A Synoptical Exposition.

There appears upon the Root of all the Ribs a very considerable Nerve divided by several Ganglions; of which the superior, situated upon the Root of the first Rib, is called the superior thoracic: That Nerve which is called the intercostal, diminishes greatly towards the Diaphragm; sometimes it is scarce perceptible, if we do not destroy the cellular Substance that surrounds it. From about the sixth Rib to the Diaphragm it divides into three or four Branches that run on the Body of the Vertebrae: They reunite into a single Cord that goes upon the Aorta to penetrate thro' the Diaphragma, and form in the Abdomen the semilunar Ganglion which we shall mention hereafter. It appears again between the Ribs of the Nerves that follow their Direction; it is the dorsal Nerves proceeding from the Medulla Spinalis: They communicate very plainly with the intercostal by Filaments already mentioned.

When we raise the Aorta, and divide it from the cellular Substance, we discover the inferior intercostal Arteries which pass behind the intercostal Nerve to go between the Ribs in following their Direction, the same as the dorsal Nerves.

The intercostal Veins, which are easily traced to the Azygos, accompany them. If we put a little aside the subclavian Artery in carrying it towards the superior thoracic Ganglion, we easily discover the Trunk of the superior intercostal Artery that runs upon the first dorsal Nerve; that of the superior intercostal Veins is pretty remote from it; it ascends to the intercostal Nerve to go to the Vena Azygos.

In the right Cavity of the Thorax we observe the same Parts, with this Difference only; that, in lieu of the Aorta, we observe a pretty considerable Vein, that runs on the Side of the Oesophagus, named Vena Azygos. It bends near the fifth  
dorsal



dorsal Vertebra to empty itself into the Vena Cava. The Azygos receives all the intercostal Veins on both Sides, when it is single, its Size being then very large, and diminishes in Proportion to that of the Branch that has been met in the left Cavity. Upon the convex Surface of the Diaphragm is seen the Division of the Arteries and Veins of that Part, which may easily be traced to their Origin.

We have mentioned, that we might discover, in the superior Part and its Middle of the Thorax, behind the Thymus, the left subclavian Vein that runs to the Vena Cava, formed by the Concourse of the two Subclavians, which will make us know the right subclavian Vein, it being shorter than the former. If we remove all those Vessels, and free a little the Aorta, we see its winding Part, that runs in three large Branches. The most anterior one is the right subclavian Artery, which runs immediately before the Trachea Arteria; the second is the left carotid, that ascends; the third, and deepest, is the left subclavian. The right one, at the Distance of an Inch, gives Birth to the right carotid, which is, at least, as large as the following Trunk of the subclavian that goes towards the Humerus. If we follow a little this last, we soon meet with the Trunk of the Par Vagus, which Cord leaves in that Part a very obvious Nerve that embraces the subclavian Artery posteriorly, to ascend again towards the Larynx; it is called the recurrent. After having freed the winding Part of the Aorta, and met with the left Trunk of the Par Vagus, we perceive the recurrent Nerve on that Side which embraces the Aorta posteriorly, to go towards the Larynx, the same as its Fellow.

The recurrent on each Side, or the Trunk of the Par Vagus, in that Part throws some Nerve  
that

## ccii A Synopfical Exposition.

that runs behind the Origin of the Aorta to form the cardiac Plexus. Relating to the intercostal Filaments which contribute to form the said Plexus, we must not expect to see them, if we do not take them at their Origin, in discovering the Trunk of the Intercostal at the superior Part of the Neck. Behind the right Subclavian we meet with the Trachea Arteria, and then its Division, the Glands of the Bronchia, and many other Parts, that belong to the Lungs.

5. THE ABDOMEN. After we have opened the Peritonæum on one Side, and turned back the Pieces, we see, in raising the Umbilicus, or Navel, that falciform Production of the Peritonæum which serves as a Ligament to the Liver, and the inferior Margin sustains the umbilical Vein. The Peritonæum being entirely destroyed on both Sides, one at once observes several Parts, which are, 1. The Liver, placed in the superior Part of the Abdomen, on the right Side. 2. The Stomach, lying almost all on the left Side, and that the Liver partly covers. 3. Under the Stomach a fatty Membrane that hangs loose upon the Intestines, covers the greatest Part of them, and is named Epiploon, or Omentum. We may see thro' that Membrane, under the Liver and Stomach, a great Intestine, which is situated transversely, and serves, with the Stomach, as an Origin to the Epiploon; it is the middle Portion of the Colon. We also discover, without any Preparation, in pulling back the Epiploon upon the Stomach, 1. A great Part of the Jejunum, which lies almost entirely on the left. 2. A considerable Portion of the Ilium, whose two Thirds are lodged on the right, and is what is called the great Pelvis. 3. A Winding of the Colon, that appears on the left Side of that Cavity. 4. The Bladder, lodged in the small Pelvis.

vis. We do not mention some Portions of the Mesentery which appear between the Sides of the Intestine.

In raising the Liver, we discover, 1. The Gall-Bladder. 2. The Epiploon minor, situated between the Stomach and that Viscera. 3. The Lobule of SPIGELLIUS, which appears thro' the Epiploon minor. We find besides, in that Part, 1. The biliary Vessels, known by their Colour; the Vena Cava, known by its Greatness; and the hepatic Artery, distinguished from the other Vessels by its Solidity. 4. The Plexus Hepaticalis, which embraces this last, &c. All those Parts appear only in their full View when we have made some suitable Preparation.

We observe again, in raising the Liver, the Pylorus, or interior Orifice of the Stomach, with the Origin of the Duodenum, which commonly touches the Gall-Bladder, the Stomach being separated from the two Epiploons; and discover, in raising it, 1. The Pancreas, known by its transverse Situation and Solidity. 2. The Spleen, which is fastened to the Stomach by the left lateral Part of its Basis. If we separate the middle Part of the Colon of the epiploic Production, which makes it adhere to the adjacent Parts, and turn it back upon the Stomach, we discover the Duodenum in all its Extent and the Beginning of the Jejunum, and all the Continuation of that Intestine, which, as we have said, is placed almost entire in the left Cavity of the Abdomen.

In removing the Ilium, lodged particularly in the right, we see on that Side the Origin of the Colon, the Cæcum and its vermiformis Appendix. If we pull aside the Jejunum, we see, under the Spleen, a Continuation of the Colon, which may be easily traced to its Curvature; from thence we go on very easily to the last of the great Intestines

called

## cciv A Synoptical Exposition.

called Rectum, easily discovered by pulling aside the Ilium and inferior Bendings of the Colon.

After having considered the Intestines fixed to the Mesentery, and raised them, we perceive, without any more a-do, 1. The principal Branches of the Mesentery. 2. The Bending of the Duodenum that runs thro' it. 3. The Pancreas in all its Extent. 4. The Ligaments of the Liver and Spleen. The other Parts are covered over by the Peritonæum, which must entirely be raised. After having done this, 1. The Aorta and Vena Cava running parallel upon the Body of the Vertebra. 2. The Vena Porta. 3. All the Branches and Ramifications of those Vessels. The Kidneys are placed by the Aorta and Vena Cava: Upon the superior Part of them we perceive the atrabiliary Capsules; sometimes they are at a small Distance. The psoas Muscle that belongs to the Thigh is placed by the Side of the lumbal Vertebrae; the iliac occupies the Cavity of the Ossa Ilii; above that Bone we see the Quadratus.

As to the Nerves, we find those of the Par Vagus upon the superior Part of the Stomach: We easily discover the Origin of the intercostal, after it has perforated the Diaphragm, if we seek for it above the Origin of the Psoas, in regard to the Plexus those two Nerves form in the Abdomen, as they do not appear without Preparation.

The Ureters may easily be traced from the Kidneys to the posterior Side of the Bladder near the Vesiculæ Seminales, in Men.

The spermatic Vessels in Men rise a little lower than the renal Arteries, and run under the Peritonæum, on the psoas Muscles, pass the annular Aperture of the abdominal Muscles, and are distributed on the Testicles; and in Women on the Uterus. Those Tubes which rise from that Portion of the Testicle called the Epididymis, are

are the Vasa Differentia, which bring the secreted Semen into the Reservoirs which are called Vesiculæ Seminales, which are situated on that posterior Part of the Bladder which adheres to the Rectum.

As for the Penis, it requires very little Preparation after the Cutis is raised, and its proper Muscles easily discovered.

For the Parts of Generation in Females; when the Cutis is removed, and the Fat destroyed over the Os Pubis, we discover the Clitoris and Nymphæ, which are continued on the Sides of the Labia of the Vagina: Immediately under the Head of the Clitoris we find the urinary Passage; lower down is the large Aperture called the Vagina, which is the external Passage of the Womb, at the Bottom of which we observe the Os Tincæ, or internal Orifice. When we examine the Womb as it lies in the Pelvis, we first observe the Fundus and Ovaria, which lie laterally by the Fallopian Tubes, under a Portion of the Duplication of the Peritonæum called the large Ligaments; and another Ligament, rising from the Fundus of the Uterus, passes thro' the Aperture of the abdominal Muscles as the spermatic Vessels do in Men, and terminates aponeurotically upon the Os Pubis.

6. THE SUPERIOR EXTREMITY. We consider in this Head not only all the Parts of the Arm, Cubit, and Hand, but also what we meet upon the Scapula; because the Connection there is between that Bone and the superior Extremity, hinders one from dividing them.

THE SCAPULA SEEN BY ITS EXTERIOR SURFACE. We meet with a large Muscle that belongs to all its Spine, and a Part of the Clavicula; it is the Trapezius. There are two others which have their Insertion at its Basis: The superior is the Elevator Scapulæ, which occupies the superior  
Angle

## ccvi A Synoptical Exposition.

Angle of that Bone and the fourth Part of its Basis; the inferior is the Rhomboïdes: This last has its Rise from what remains of the same Basis. Behind the Trapezius, in the supra spinal Cavity, lies the Supra Spinatus; the Infra Spinatus is lodged in that Cavity below the Spine. We find after this, upon the same Level, the Teres Minor; under this Muscle lies the long Head of the Brachialis Triceps, and then the Teres Major that comes from the inferior Angle of the Scapula. Upon the anterior Angle of this Bone a Portion of the Deltoïdes is seen, and the external Scapula in a Sciffure of the superior Rib.

THE SCAPULA SEEN BY ITS INTERIOR SURFACE. The Muscles which proceed from the Basis of that Bone are, as we have already said, the Rhomboïdes and Elevator: They appear much better on that Side. The Sub-scapularis fills the interior Surface of the Scapula; the coracoïd Process gives Rise to two Muscles, which are, the Coraco-Brachialis, and the long Head of the Biceps; the second Head of that Muscle comes from the Margin of the articular Cavity of the Scapula. The Vessels we meet behind this Bone, are Branches of the interior Scapula.

THE ARM SEEN ANTERIORLY. We must consider under the Arm, behind the Pectoralis Major and Minor, Nerves and Vessels, which are the most considerable of the superior Extremity.

The basilic Vein, that receives the principal cutaneous Veins of the fore Arm, is the most considerable and superficial; the brachial Artery runs by the Coraco-Brachialis as far as the fore Arm; the posterior brachial Vein is not far from it, and runs in the same Direction. The first Nerve that presents itself is the median, which runs anteriorly towards the Middle of the fore Arm; the cutaneous Muscle follows it, and runs through the

coraco-brachial Muscle: These two Nerves commonly run from the same Origin. Next to the Basilica is seen a little Nerve, which accompanies that Vessel to the Arm; it is the Cutaneus: After this, we see the Cubital that runs behind the internal Condyle of the Humerus. Its two lowest Muscles are; the articular and radial, which commonly proceed from the same Cord: The first is the shortest, and runs behind the superior Extremity of the Humerus near the Articulation; the second passes also posteriorly towards the Middle of the Humerus, and pierces in that Part the Triiceps Brachialis, to go towards the lateral Part of the Arm, where it meets the superior Extremity of the Supinator Longus, before which it passes in the anterior Part of the fore Arm.

The cephalic Vein runs on the external Part of the Arm, and goes afterwards to the Deltoïdes, to empty itself into the Subclavian.

The Deltoïdes is the first Muscle that presents itself upon the superior Part of the Arm, behind its lateral internal Side; then is seen the Tendon of the Pectoralis Major; after this we discover the two Heads of the Biceps, situated on the anterior Part of the Arm: Behind the Tendon of the Pectoralis Major and the long Head of the Biceps, which is the most interior, is seen the Coraco-Brachialis, whose Origin is confounded with that of this Head: Behind the inferior middle Part of the Biceps we find a Muscle that embraces the Humerus; it is the Brachialis: By the Side of this Muscle, exteriorly, is met with a considerable Portion of the Supinator Longus.

THE ARM SEEN POSTERIORLY. We first find a Muscle with three Heads, named Triiceps Brachialis; the long Head hides the Tendon of the Teres Major: By the Side of the same Head is seen a Portion of the Deltoïdes.

## ccviii A Synopfical Exposition.

THE FORE ARM SEEN ANTERIORLY. If we give the Hand the Situation it ought to have in Supination, we see, in the lateral exterior Part, the Supinator Longus; towards the internal Side we find, upon the superior Part of the Radius, a Muscle that embraces it; it is the Supinator Brevis: Under it is situated the Pronator Teres. It surrounds equally the Radius, tho' in a contrary Sense. Its superior Head is at the internal Condyle of the Humerus. Between these two last Muscles is found the Tendon of the Biceps and Brachialis: The aponeurotic Tendon of the former throws itself upon the Pronator Teres and the other Muscles that are upon the same Level; then comes the Radialis Internus, and afterwards the Palmaris Longus; next to which comes the Cubitalis Internus; all arising from the internal Condyle of the Humerus.

Behind the Palmaris Longus and Radialis Internus we find the Perforatus, whose Tendon passes under the transverse Ligament; behind this we discover the Perforans, and next to that the Flexor Pollicis: Behind all these Tendons, and above the Wrist, is situated the Pronator Quadratus, immediately upon the Extremity of the two Bones of the fore Arm.

The median Nerve runs between the Perforatus and Perforans, the Radialis before the anterior Margin of the Supinator Longus, the cubital Nerve all along the anterior Border of the internal cubital Muscle, the ulnaris Artery is situated anteriorly along the Margin of the perforans Muscle.

Behind the Flexor Pollicis we observe the Interossea, with a Ramification of the median Nerve that accompanies it: Upon the Tendon of the Brachialis is seen the Profundus.

THE FORE ARM SEEN POSTERIORLY. In beginning towards the Cubitus, we consider, upon the  
the



## A Synopſical Expoſition. ccix

the ſuperior Part of that Bone, a little Muſcle called the Anconæus; afterwards the cubital Externus; then the Extenſor Communis and Indicator, that runs upon the ſame Level with this laſt.

Under the Indicator is met the Extenſor Minor Pollicis, and after this we ſee the Major of the ſame; afterwards the Radii Externi, and, in fine, the poſterior Surface of the Supinator Longus.

THE HAND SEEN ANTERIORLY. The Aponeuroſis Palmaris, the ſmall Muſcle of the ſame Name, and the tranſverſal Ligament, are the Parts that appear firſt. After having deſtroyed them, and the ligamentous Capſula that ſurrounds the Tendons of the Flexors, we ſee the Tendon of the Perforatus, whoſe Extremity is bifurcated, to let thoſe of the Perforans paſs. In raiſing the Tendons of the Perforans, we obſerve the Lumbricales. The Metacarpus is ſituated by the Palmaris Brevis, conſidered alſo towards the Thumb, the Tendon of its Flexor. We ſhall not mention the Laterales, their Situation being very viſible. We obſerve before theſe Muſcles an arterial Segment; it is the palmary Arch.

THE HAND SEEN POSTERIORLY. Upon the Carpus is ſeen annular Ligaments, four in Number. The firſt receives the Tendon of the external Cubitus; the ſecond thoſe of the Extenſor Communis and of the Indicator; the third that of the Extenſor Brevis Pollicis, and the fourth thoſe of the Radius. There appear beſides, upon the Back of the Hand, many of the lateral Muſcles and ſome Veſſels.

7. THE INFERIOR EXTREMITY. All the Muſcles belonging to the Femur ought to be comprehended in this Article; therefore we ſhall mention ſeveral which are in the Abdomen, the large and

## ccx      A Synopfical Exposition.

small Pelvis, and upon the Parts of the Bones that form those Cavities.

THE THIGH SEEN ANTERIORLY. The Teguments being raised, we discover, 1. Under the Groin, the inguinal Glands. 2. All along the interior Side of the Thigh a very considerable Vein named Saphæna Major. 3. Towards the genital Parts, the external Vein of the Groin, and the Artery of the same Name; Vessels which require some Preparation. All the Thigh seems then to be covered with an aponeurotic Membrane, which is thicker anteriorly; it is named Fascia Lata. After it is destroyed, and the Fat that is under the Groin taken away, we perceive the crural Vessels; but ought to observe, that about the inguinal Ligament the Artery is the most anterior, and more external. These two Vessels march between the Psoas and Pectinæus, in covering a Portion of both of them. The crural Vessels being arrived near the middle Part of the Thigh, pass under the Sartorius that hides them: Next to the crural Artery, towards the Os Pubis, and under the inguinal Ligament, we meet with a considerable Nerve, that run between the Psoas and Iliac; it is the crural: It divides in entering into the Thigh; and it is very easy to follow its Branches.

The first Muscle that presents itself after these Vessels in the anterior Part of the Thigh, is the Gracilis, running towards the external Part, we meet with the first Portion of the Triceps, which has its Head by that of the preceding one: Then comes the Pectinæus, which is partly covered by the crural Vessels that appear after this last, the Extremity of the Psoas, which is almost covered by the crural Nerves and Vessels. Its Body is placed in the Abdomen upon the lumbal Vertebra and Offa Pelvis. Then comes the Ilium, whose  
Body,

Body, situated in the great Cavity of the Pelvis, occupies the same; after this comes a very long Muscle, which, from the exterior Part of the Thigh going obliquely towards the interior Part, terminate in the Leg; it is the Sartorius. Behind its superior Origin we find the Tendon of the Rectus, whose Body occupies the most anterior Part of the Thigh; the Spinatus, which terminates at the Fascia Lata, touches the superior Extremity of the Rectus, its superior Origin meeting that of the Sartorius. Behind the Muscles already named we meet with many more. 1. The second Portion of the Triceps Femoris, that lies directly after the first and superior Part of the Gracilis. 2. The third Portion of the Triceps, whose inferior Part only is seen under the former. 3. The Obturator Externus, which we must look for before the Foramen, and behind the middle Portion of the Triceps, between that and the Pectinæus. 4. The Vasti Internus and Externus, and the crural which embraces all three, and the Bone of the Thigh as far as the Leg. The Rectus is intermixed with these three Muscles, all these forming a single Membrane which covers the Patella. The crural is directly behind the Rectus, and is confounded with the Musculi Vasti; but they are easily distinguished, by the Direction of their Fibres.

THE THIGH SEEN POSTERIORLY. We shall comprehend all that is from the external Margin of the Ossa Ilei to the Articulation of the Femur with the Tibia. The most considerable one is the Glutæus Maximus, which covers the greatest Part of the Glutæus Medius, Glutæus Minimus, &c. this Muscle also covers the Trochanter Major, and extends itself to the third superior Part of the Os Femoris. After having divided it from the Ossa Pelvis, and turned it back, we see, in its interior

## ccxii A Synopsical Exposition.

Surface, the glutæus Artery and Vein : The Glutæus Medius, which follows the Major, the most superior of them, terminates at the Trochanter Major. We perceive, after having raised them, many Muscles disposed like a Web, which terminate about the Trochanter Major.

The first, in beginning by the lateral (exterior) Part, is Glutæus Minimus ; then follows the Pyramidalis, that comes out of the Pelvis by the ischiatic Opening ; after this is seen the Cannularis, which is hollow, to give a Passage to the Tendon of the Obturator Internus, whose Body is situated in the small Cavity of the Pelvis behind the Foramen Ovale : The last, which is near the Tuberosity of the Ischium, is the Quadratus, which is seen under the Pyramidalis upon the Cannularis, a considerable Cord called the great sciatic Nerve ; the Vessels that accompany it are the Artery and sciatic Vein : We also observe, relating to the interior Obturator, that it comes out of the small Cavity between the ischio-sacra Ligaments.

All the Parts we have examined have a relative Use to the Thigh ; but, by their Situation, it seems as if they did not belong to it : These are those which enter its Structure.

Beginning interiorly, we meet, 1. The Gracilis, a Muscle already observed in the Thigh seen anteriorly. 2. The Sartorius, whose inferior Portion only is seen. 3. A Portion of the Vastus Internus. 4. All the posterior Portion of the Triiceps that extends from the Tuberosity of the Ischium to the internal Condyle of the Femur.

There are, besides, three Muscles, that arise from the same Tuberosity, called, 1. The Semi-nervosus. 2. The long Head of the Biceps. 3. The Semi-membranosus. If we consider them in the inferior and middle Part of the Thigh, they have another Order. The Semi-membranosus is

the most interior; the Semi-nervofus follows, and the Biceps is the most external: The short Head of this last terminates a little above the middle Part of the Os Femoris.

The crural Vein and Artery go, as we have said, towards the posterior Part of the Thigh, and appear under the Articulation of the Knee, where they are called POPLITÆ. They meet in that Part the sciatic Nerve which accompanies their Divisions.

THE LEG SEEN ANTERIORLY. In the internal Part we discover the Saphæna Major, which runs upon the Back of the Foot towards the Great Toe; and see, besides, a Part of the posterior Muscles; which are, the Gemini, Solæus, Profundus, and Tibialis Posticus: They appear in that Order in descending towards the Malleolus. Upon the exterior lateral Part of the Tibia, the Tibialis Posticus, whose Tendon crosses the Leg, and goes towards the internal Part of the Back of the Foot.

The tibial Artery runs behind this Muscle, between its Body and that of the Extensor of the Pollicis; we also observe behind the Tibialis Anterior the Extensor Pollicis, which has almost the same Direction; then is seen the Extensor Communis for the four small Toes, a fifth Tendon that appears upon the Back, and terminates on the last Bone of the Metatarsus, belongs to the anterior Peronæus, whose Body is commonly mixed with the Extensor Communis. Those four Muscles are all situated in the anterior Part of the Leg between the Tibia and Perinæus. There appear, besides these, upon the lateral Part of the Perinæus called the Peronæus Longus and Brevis, their Tendons, which pass behind the external Malleolus.

THE FOOT SEEN IN THE SAME SITUATION. We observe, upon its Back, the Tendons of the Tibialis Anticus, Flexor Pollicis, and those of the Extensor Communis, being four in Number; and afterwards that of the Peronæus Anterior: The Pedialis is situated upon the Back of the Foot, under the five last Tendons. We must consider between the two Malleolæ Aponeurotica Annularia to give a Passage to the Tendons. They are three in Number: The first for the Tibialis Anticus, the second for the Extensor Pollicis, the third for the Extensor Communis, and the Peronæus Anterior.

THE LEG SEEN POSTERIORLY. There appears at first some cutaneous Vessels, which are Branches of the Saphæna Minor. The Muscles are, 1. The Gemini, which form the Calf of the Leg. 2. The Solæus, situated behind the former. From all these Muscles proceeds a very strong Tendon called Tendo Achillis, which terminates at the Heel; behind the superior Extremity of the Origin of the Gemini we discover the Plantaris: Its thin Tendon goes towards the internal Part of the Leg, to accompany that of the Achillis to the Heel.

After these Muscles are seen, in the internal Part, the Flexor Brevis, or Perforatus, whose Tendon passes behind the internal Malleolus which goes towards the Foot; the Tibialis Posticus that runs equally behind the Malleolus; the Flexor Pollicis, which runs, with the preceding ones, behind the internal Malleolus, but near the Heel; then the Peronæus Longus and Brevis Posticus: We meet behind the Solæus a considerable Artery, with its Vein and Nerve, which goes behind the internal Malleolus, running between the Tendon of the Flexor Brevis and Flexor Pollicis; it is the Tibialis Posticus: It is also to be observed behind the

the Body of the same Muscle. Between it and the Peronæus an Artery descends to the 'internal Malleolus; it is the Peronæa.

THE SOLE OF THE FOOT. First we observe an Aponeurosis: Having divided it, we discover the Perforans, whose four Tendons run thro' those of the Perforatus; these are directly situated behind those of the former. In raising them we find the Musculus Accessor and Quatuor Lumbrici. The other Muscles of the Sole of the Foot belong to the Laterals; their Situation will make them observable.

We also meet here, near the Root of the Finger, an arterial Segment, the same as in the Hand, which is the Arcada Plantaris. It is not always well formed.

\* \* This ESSAY is taken from Dr. LIEU-  
\* TAUD's *Essais Anatomiques*, with some Im-  
provement.









A  
C O U R S E  
O F  
Anatomical Lectures.



L E C T U R E I.  
A N T H R O P O S O P H Y.

**T**HE human Body, as well as those of other Animals, is composed of Solids and Fluids.

We understand by a Solid, any extended and resisting Object of our Senses, whose Parts have more or less attractive and cohesive Force one to another. If this Cohesion betwixt the Parts is sufficiently strong, to keep them in their Situation, (contrary to the Force by which they tend to the Earth's Center) and preserve the natural Figure of the Body, we call it a Solid; but if it be so weak, that the Gravitation of Parts brings them to a Level, or to a Portion of the Earth's Convexity, when left to themselves, we

name it a Fluid. When the Cohesion of Parts is neither sufficiently strong to retain the Figure, nor weak enough to let them flow to a Level, we term it a soft Body, in various Degrees, till we come to the Cohesion of a Solid, which we call Hardness. Hence we see, that, by lessening the Cohesion and Contact of Parts, the same Body may be either solid, soft, or fluid; as for Example, the White of an Egg, by different Degrees of Heat, lessens the Attraction of Cohesion in the constituent Particles.

The primitive Anatomists, who made a general Division of the Parts of the Body, merely from the outward Appearance of their Structure, called some Similar or Simple, and others Organical or Compound. But the Moderns usually reduce all the Solids under certain general Classes, expressed by the Names of Fibre, Bone, Cartilage, Ligament, Membrane, Vessel, Artery, Vein, Nerve, Muscle, Gland, Fat, Viscus, and Organ.

All these arise first from Filaments, which are generated in a mucilaginous Matter, composed of Spirit, Water, Oil, Salt, and Earth. This glutinous Substance incorporated together, forms the whole animal Oeconomy.

The similar or simple Parts of the Animal, properly speaking, are only single Fibres, as they constitute all the rest of the Body.

A Fibre is the most simple Filament that can be divided from the Substance of any Animal, and so minute as hardly to be perceived by the naked Eye, but when reviewed through a Microscope, it appears still to be composed of others.

The Figure of a Fibre is cylindrical, and its Direction either rectilineal, oblique, longitudinal, transverse, circular, spiral, large, small, or short. And the more constant or permanent Parts thereof are Earth.

These

These terrestrial Particles have not their Connection and Power of Cohesion from a mere Contact, but from the intermediate glutinous Matter diffused betwixt them \*.

The terrestrial Particles cohere longitudinally by the intervening Glue, from the first most simple Fibres: [as the best Microscopes cannot assist us to inspect those minute moving and nervous Fibrils, therefore how can we have an Idea of their Mechanism, by which Sensation is effected? Or how Motion is modulated to produce the animal Sensation, or animal Sense and Will can produce Motion, we can only conjecture?] These Fibres are divided into two Sorts; the first we have already described.

The second Kind are those which connect in Breadth, from what is called cellular Substance, which is partly composed of the simple Fibrils, with an Infinity of Lamelles, which, connected in various Directions, intercept the small Cells, and web-like Spaces; extending to every Part of the Animal, even to the least moving Solid, in collecting them in such a manner, as not only to sustain, but also to allow them a full and free Motion. But, however, we observe this cellular Membrane differ vastly in various Parts of the Animal, in respect to the Proportion betwixt the membranous Sides and intercepted Cells, as in the Breadth and Strength of those Sides, and the Nature of their contained Fluids, which is sometimes more aqueous, and at other times more oleaginous.

---

\* This glutinous Matter is composed of Oil, combined with Water, by which the vital Attraction in Animals, as appears from the chymical Analysis of the Bones dissolved into a Jelly.

This cellular Substance in its ultimate or finest State, being still composed of simple Membranes, when compacted and convoluted, gives Birth to the most minute Vessels, which, again reflected through the Laminæ of the same Substance compacted together, form compound and vascular Membranes, &c.

From the cellular Substance being compacted by a Concretion of the membranous Lamellæ, and pressed together by the Force of the incumbent Muscles and distending Fluids, arise other broad and flat Laminæ in various Parts of the Body; which, being generally disposed in one and the same Direction, and these being convoluted into Cones and Cylinders, pervade by some Fluids brought to them, take the Name of Vessels, or else being extended round some Space, that is in a Place parallel to itself, we call it a Tunic or Coat. But that Tunics are formed from the cellular Substances, is proved by ocular Inspection, especially in the Aorta or Dura Mater by Maceration; and the Tunics of the Muscles are evidently of a cellular Substance, while they resemble the Texture of other Membranes from a Degeneration of the Pericardium, as a true Membrane into the cellular Substance, or Membranes of the Aorta and Pulmonary Arteries; from the Origin of the hard and thick Membranes which are formed about encysted Tumours, and which is only in the cellular Substance. In short, how easy the Dartos of the Testicles and the nervous Tunic of the Intestines are changed by Inflation into cellular Substance, or by impelling Air into the Aorta of a Fœtus, as I have sometimes inflated the whole Body, even into the Cavities of the Bones; that it is evident those filamentary Fibres are first formed by a transfused Glue, and likewise the membranous Fibres of the cellular Substance

## Lect. 1. Anthroposphy. 5

stance has the same Origin, as appears from those cellular Fibres produced in the Thorax from a concreted Vapour or Serum, transfused through the Surface of the inflamed Lungs, which are thereby connected to the Pleura; for these perfectly resemble the true and cellular Substance. The same appears also in comparison of a Fœtus with an Adult, as the subcutaneous cellular Substance of a Fœtus. This we are convinced of by the fibrous Collection we extract from the Blood when coming from any Animal, by stirring it round with a Probe while warm. Likewise we find that the bony Fibres are but a mere coagulated Glue, as in some Diseases they become soft as a Cartilage, and are by Art dissolved into its primogenial State by P A P I N's Digestor.

Hence it is evident that the animal Solids begin, when in a gelatinous State not unlike the White of an Egg, by a small Portion of fine cretaceous Earth to run together into a Thread by Compression. Such a Filament, by the mutual Attraction of Cohesion intercepting Spaces betwixt itself and others, helps to form a Part of the cellular Substance, after having acquired some Consistency from the adjacent terrestrial Particles, which remain after an Expulsion of the redundant aqueous Glue.

And in this cellular Substance, whenever a greater Pressure is imposed on the Lamellæ, they degenerate into Fibres, Membranes, Tunics, and lastly into Bones; then they concrete with an unorganized Glue. Hence all the Parts of the Animal, from the softest to the hardest, seem to differ no otherwise than that some have more of the terrestrial Particles closely compacted together, with less of the aqueous Glue; and others have less Earth.

Therefore the human Body is formed of Clay, or slimy Earth, as all the Solids, and even the globular Fluids which circulate, are generated of chalky Particles, as we see in calcining a Lump of Blood, or a Bone, after the Air, Water, Salt, and Oil, which make the glutinous Substance, are expelled or consumed, there remains a white, friable, chalky Earth, similar to the elementary ones.

We may therefore very well admire the wonderful Acts of Nature, in her wise Oeconomy and Simplicity, in forming all the Variety of the animal Fabric from a mere simple Earth and Glue ; whence the Animal is not only increased from its first Rudiments in the Ovum to its full Growth, but repaired every Moment during Life, till perhaps at length not two Jots of the primitive Materials remain.

This Renovation of Parts is made slower in some Organs and Constitutions than in others. As for Example, how quickly the Hair, Nails, &c. are renewed ; which has occasioned some Authors to conjecture, that once in three Years the human Substances may be universally changed, though a Person remains the same identically, yet he has not the same Materials ; if it was so, I think we should never grow old.

By a MEMBRANE we understand a pliable Texture of Fibres, disposed or interwoven together in the same Laminæ. They differ in Thickness according to the Smallness of the Filaments, and Number of their Lamellæ.

These Lamellæ are distinguished by External, Internal, and Middle

The difference of Membranes in general depends on that of the Fibres, of which they are composed ; small Portions of Membranes, especially when they are very thin, are called Pelli-  
culæ,

culæ, and some membranous Laminæ are united together by the Intervention of a particular Substance composed of this Sort of Pellicles, and called the Cellular or Spongy Substance.

VESSELS are Tubes, Ducts, or Canals, more or less flexible, composed of different Membranes, the Strata of which are generally termed Tunics or Coats. Some of them are divided into Branches, and these again into Rami and Ramifications, which gradually diminish, but still remain concave.

The general Design of the Vessels is to contain Fluids; from the Diversity of which they are distinguished by Sanguiferous, Lacteal, and Lymphatic; the Extremities of those which do not admit the red globous Particles, are generally termed Capillaries, or Lymphatics.

The sanguiferous Vessels are of two Kinds; one of which receives the Blood from the Heart, and distributes it to all the Parts of the Body, which are named Arteries; the other returns the Blood from all the Parts to the Heart, which is called Veins, and some of these have the Name of Sinuses.

The ARTERIES are thicker than the Veins, by which they may be distinguished in dead Bodies; and in living Subjects, by a certain Beating called the Pulse. The Veins of the Extremities are furnished with Valves, that is, with small membranous Sacculi, fixed at different Distances in their internal Cavities. The Opening of these Valves is broad, and turned toward that Side where the Vein is largest, but their Bottoms are turned to the contrary Side, where the Veins are of the smallest Diameter; in some Places these Valves are single, in others double, triple, &c.

**NERVES** are Fasciculi of white cylindrical Fibres which proceed from the Cerebrum, Cerebellum, Medulla Oblongata, and Spinalis, and are distributed to all the Parts of the Body, by filamentary Ramifications for Sensation; each nervous Filament may be looked upon as membranous Vessels; the Cavity of which is filled by a great Number of membranous longitudinal Septa and medullary Filaments which lie betwixt them.

**MUSCLES** are Collections of Fibres, called by Anatomists *Fibræ Motrices*, of a reddish Colour, and different Lengths.

The middle Portion of the moving Fibres is the principal, and differs from the Extremities, it being red, thick, soft, and capable of Contraction; whereas the Extremities are white, small, compact, and incapable of yielding.

This middle Portion of each moving Fibre form what is properly called Flesh, the Extremities are called Tendons.

**GLANDS** are Clusters or *Moleculæ*, distinguishable from all the other Parts of the Body, by their Form, Consistence, Texture, and Connection. They are in general composed of Arteries, Veins, Nerves, and excretory Ducts united together in their different Folds, and Intertextures, all invested in a Membrane.

The Office of Glands is to separate from the Mass of Blood, by means of certain secretory Vessels, Fluids, which they discharge either immediately, or by other Vessels termed Excretory; and these Fluids are either accumulated in particular Reservoirs, or expelled out of the Body.

**FAT** is of an oleaginous, white, or yellowish Substance, of different Consistencies, collected in cellulous Membranes.



MARROW is a Kind of Fat, and differs from it only in the Fineness of the oleaginous Substance, and in its Situation within the Bones. The Word Marrow is synonymous with Fat.

By VISCERA, we commonly understand Parts contained in a great Cavity, without being connected to it, through their whole Extent or Circumference, such are the Stomach, Intestines, &c. in the Abdomen, and the Heart, Lungs, &c. in the Thorax.

ORGANS are Terms given to every Part capable of any Function, whether it be simple or complex; and in this Sense we call the Organ of Sight, of Respiration, &c.

A LIGAMENT is of a white, fibrous, compact Substance, yet flexible and elastic.

A CARTILAGE is a hard elastic Substance.

BONES are the most compact Fibres of the Body; therefore the hardest Substance which forms the Basis of the whole animal Fabric, the Knowledge thereof is the fundamental Part of the animal Oeconomy, and without which it is impossible to have a perfect Idea of the Mechanism of the human Frame \*. We shall therefore begin with them.

The Fluids contained in Solids, are the Blood, Serum, Lympha, &c. from these all the other Liquors are secreted.

All the Parts of the Animal exist in Miniature, from the first Moment the Uterus is impregnated, and afterwards gradually increase by the Extension of its Parts.

---

\* CICERO observes, "Quid dicam de ossibus, que subiecta corpora  
" mirabiles commissuras habent, & ad habilitatem aptas, & ad artas  
" firmandes accommodatas, & ad motum, & omnem corporis ac-  
" tionem." Lib. II. de Nat. Deorum.

A Skeleton is an Affemblage of all the Bones of any Animal, either connected with their natural Ligaments or artificially.

Anatomifts usually apply Osteology, as a Difertation, as well as Description of the Bones, but I fhall divide it into three Heads, viz.

1. OSTEOGENY.
2. SYNOSTEOGRAPHY.
3. OSTEOGRAPHY.

As we cannot avoid mentioning feveral Parts of the Bones, it will be therefore more methodical, before we enter into the particular Examination of them to give a preliminary Idea of the whole Skeleton, by enumerating the fingle Pieces which it is compofed of.

The Skeleton is divided into Head, Trunk, and Extremities.

The Head is divided into two Parts. The first is a bony Cavity called Cranium or Skull; the other confifts of feveral Pieces, which form the greateft part of the Face, though fome Part of the Cranium contributes thereto.

The Cranium confifts of eight Bones, viz. the Os Frontis, the Forehead Bone; Os Occipitis, the Occipital Bone; Offa Parietalia, the Sinciepi-tal or Parietal Bones; Offa Temporum, the Temporal Bones; which contain four little ones, viz. 1. Incus, or Anvil; 2. Melleus, or Hammer; 3. Strapes or Stirrup; 4. Orbicular or Lenticular; Os Sphenoïdes, the Sphenoïdal Bone; and Os Ethmoïdes or Cribrofum, the Ethmoïdal Bone.

Befides thefe, we often meet with fupernumary Bones, the Size and Number of which vary confiderably.

The fuperior Maxilla, or Jaw, formed of two large Bones, called Offa Maxillaria, from the  
Word

Word Maxilla, by which this Part of the Face is expreffed ; the two Offa Unguis or Lachrymalia ; the two Offa Nafi ; the Offa Palati ; the two Offa Convoluta, or lower Shells of the Nofe ; and one Bone named Vomer. All thefe amount to thirteen, without reckoning the Teeth, which are commonly fixteen.

The inferior Maxilla, or lower Jaw, has but one Bone in Adults, and two in Children, and as many Teeth as the Superior.

The Trunk is divided into three Parts ; one commonly called the Spine ; and two proper, viz. the Thorax or Breaf, and the Pelvis.

The Spine is compofed of twenty four Bones called Vertebæ, feven of which belong to the Neck, twelve to the Back, and five to the Loins ; and a Bone, termed Os Sacrum, with its Appendix, named Os Coccygis or Coccyx.

The Thorax is chiefly formed by means of the Ribs and the Sternum. There are on each Side twelve Ribs, fixed by their posterior Ends to the Vertebæ of the Back, by their anterior to the Sternum. The fuperior feven are called the true Ribs, and the five inferior falfe Ribs.

The Sternum, or breaf Bone, confifts of two or three Pieces, lying between the anterior Ends of the true Ribs.

The Pelvis is chiefly formed by two great Bones, called Offa Innominata, subdivided, viz. Os Ilium, Os Ifchium, and Os Pubis, joined before to each other, and behind to the Os Sacrum, which completes the Pelvis.

The Extremities of a Skeleton are four ; two fuperior, which are on each Side of the Thorax ; and two inferior, joined to the Sides of the Pelvis.

Each fuperior Extremity is divided into the Shoulder, Arm, Fore-arm, and Hand.

The Shoulder is composed of two Pieces; one before called Clavicula, or Collar Bone and one behind, Scapula, or Blade-bone. The Arm is only one Bone, termed Os Humeri, or Arm-bone. The Fore-arm has two, the Ulna and Radius. The Hand is divided into three Parts; the Carpus or Wrist, consisting of eight Bones. 1. Os Scaphoïdes; 2. Os Lunare; 3. Os Cuneiforme, 4. Pisiforme; 5. Os Trapezium; 6. Os Trapezoïdes; 7. Os Magnum; 8. Os Unciforme. The Metacarpus, which is made up of four Bones and five Fingers, each of which contains three Bones called Phalanges.

Each inferior Extremity is divided into the Thigh, Leg, and Foot.

The Thigh has but one Bone, termed Femur, or Os Femoris.

The Leg is made up of two large Bones, named Tibia, or Shin, and Fibula, or side Bone, and of one small Bone called Patella or Kneecap.

The Foot is divided into three Parts; the Tarsus, or Instep, which is composed of the seven following Bones, viz. the Os Calcis, Astragalus, Os Naviculare, Os Cuboïdes or Quadratum, and all the three Offa Cuneiformia; the Metatarsus is formed of five Bones; and the Toes, which are five, the greatest consisting of five Bones each, called Phalanges, as those of the Fingers.

There are, besides these, some small Bones, which are rarely preserved in a Skeleton, viz. the Os Hyoïdes, or Bone of the Tongue, the eight Ossicula Audita, or Bones of the Ear, four lying in each temporal Bone. The little Bones sometimes found at the Extremities of the Apophyses Pterosæ, towards the Sella Turica; and the Sesamoid Bones of the Fingers and Toes.

We shall not here mention, a Kind of Sefamoïdal Bones, sometimes found on the Condyles of the Femur, at the lower End of the Fibula, at the Os Calcis and Os Cuboïdes.

After this Enumeration of the Bones of the Skeleton, we may easily determine their Number ; to the Head, belong fifty four, without reckoning either the Os Hyoïdes or the Officula Audita ; to the Trunk, fifty four, taking the Coccyx for one Bone, and the Sternum for two ; and to the Extremities, a hundred and twenty four, leaving out the Sefamoïdal Bones, so that the whole Number is two hundred and thirty two ; to which, if we add the eight Bones of the Ear, and the five principal Pieces of the Os Hyoïdes, we shall have two hundred and forty five ; the Sefamoïdal Bones not included.





## LECTURE II.

### OSTEOGENY, or the Nature and Generation of Bones.

**T**HE Bones are the hardest and most compact Fibres of the Animal connected to one another by some small transverse Filaments, which are in a Fœtus very conspicuous.

The Substance of the Bones is found on Examination to be a Texture of solid Fibres, differently disposed, according to the particular Conformation of each Bone.

These bony Fibres are easily distinguished on the Surface of the Ribs, where they may be separated much after the same Manner as we do those of Whale-bone or Horn. We may likewise perceive them by the Fissures in Bones, which have been long exposed to the Sun or Air, or otherwise dried.

These Fibres in general are so disposed, as to form in some Bones, Laminæ of a considerable Extent, and in others Filaments of different Sizes.

The general Structure of the Substance of the Bones consists in their Disposition and their Substance; which is partly compact or solid, partly cellulous or spongy, and partly reticular.

The

The Solidity of the Bone lies chiefly externally, and the Cellulous internally. The first, is most considerable in the large cylindrical Bones; the other in those which have no remarkable Cavities.

The solid Part is formed by Laminæ in different Strata.

The Spongy consists chiefly of Laminæ and Filaments variously interwoven. The Filaments alone, from the reticular Texture, principally observable in the long cylindrical Bones.

The external Laminæ may be observed to lie in pretty regular Strata, but more especially internally; this Disposition is gradually altered; these appearing in some Measure to lie in Gathers, or unequal Folds, are all interiorly perforated, as so many Apertures of different Sizes and Figures. In the same Manner do the Laminæ, which compose the solid Parts of Bones, change their reticular Disposition to form what is called the cellulous or spongy Substance, which forms almost the interior Texture of the Bones, and has no large Cavities. In all the Epiphyses of the convex Bones, this is found only near their Extremities.

The Cells, or void Spaces, in this spongy Part are more considerable in some Bones than in others; and the Laminæ, which compose them, differ in Form, as well as Extent, being more or less flat, crooked, twisted, angular, irregular, thick, thin, broad, narrow, &c.

In many Bones these Laminæ appear to degenerate into small Filaments, so that the cellulous Part of such Bones is, as it were, a Mixture of Lamellæ and Filaments, representing a Kind of fine Sponge. In some Bones a certain Regularity may be observed in the Disposition of them.

Besides the small Filaments found in the cellulous Part of Bones, there is a reticular Texture of them in the Cavities of several long Bones; the Fibres of which Net-work are long fine Branches, pliable, and curiously interwoven at different Distances.

This reticular Texture may be said to arise partly from the interior Sides of these Bones, partly from their Extremities from cellulous Portion. Several Ramifications are produced from it, which appear as it were suspended through the whole Length of the Cavity of the Bone, meeting and uniting together; which, however, are always at a considerable Distance from each other\*.

Besides the Cavities which appear in examining the external Conformation of Bones, there are several others observable in examining their internal Structure, which may be all reduced to three Kinds, very different from one another.

The first Kind comprehends the large internal Cavities, found chiefly in the Middle of the long Bones, which are nearly of a cylindrical Figure; such as the Humerus, Ulna, Radius, Femur, Tibia, Fibula, the Bones of the Metacarpus, Metatarsus, Fingers, and Toes. In these the Cavities are proportionable to the Length and Thickness of the Bones.

The Surface of these Cavities is more smooth and even than near the Extremities, where they become more rough, unequal, and furrowed, according as the Disposition of the Laminæ happens to be changed, and osseous Productions, or cross

---

\* This Texture is very often destroyed in taking out the Marrow of Bones that are designed for a Skeleton.



Pieces, may sometimes be observed in them, which are either single or combined together different Ways. The reticular Texture already described, is chiefly found in these large Cavities.

The second Kind of internal Cavities consists of Cells and Intervals in the cellulous Portion of the Bones. Some are large, small, single, double, or more compounded, and of these last some contain several small ones within them. Others are round, flat, oblong, tubular, oval, angular, square, irregular, &c. And of these the Oblong and Tubular lie in Directions nearly parallel to the Length of the Bone. Most of the Cells communicate with one another in a different Manner.

The third Sort of internal Cavities comprehends the Ducts and Pores found in the Substance of Bones. Some of these Ducts are very small, and lose themselves in the inner Substance of the Bone; the rest are larger, which having penetrated the Substance of the Bone for some space, obliquely pass quite through it afterwards.

These latter are but in small Numbers, and more seldom met with in the middle of Bones, than about their Extremities and Edges. But the former are very numerous, and lie commonly in a Direction parallel to the Length or Breadth of the Bone.

The internal Pores, though imperceptible to the naked Eye, are plainly discovered by the yellowish Matter which transudes through Bones long kept without being prepared.

All that has been said about the internal Structure of Bones may be exemplified in the Femur, by sawing it through the Middle lengthways.

For thus we discover the three different Substances very plainly, the middle Part consisting of a Tube, with thick Sides formed by the compact

or solid Substance alone ; the Extremities made up chiefly of the cellulous and reticular Substances observable in the middle Cavity.

The Laminæ of the solid Part are gradually separated from one another towards the Extremities, being connected by small lateral Laminæ differently disposed in form of Cells. From this Disposition the Laminæ came to be of different Lengths ; those near the Surface of the Bone reaching to the very End thereof, the rest which lie more internally, decreasing gradually in Length ; thus the interior Laminæ are the shortest, the exterior the longest, and the intermediate ones of different Lengths between these two Extremities.

Therefore the solid Substance of the Femur is very thick in the Middle, but grows gradually thinner towards each End, appearing there only as a bony Crust laid over the cellulous Substance. It may likewise be observed, that the most interior Laminæ are less smooth and even than the other, lying, as has been said, in Gathers or Folds with some opening between them, and very irregular.

GAGLIARDI says Laminæ are firmly joined to each other by means of a great Number of Claviculi, or small bony Processes, which, rising from the interior Lamellæ, pierce through some, and are fixed into others of the more external Laminæ. He has described and represented four different Species of these bony Nails, viz. the perpendicular, oblique, headed, and crooked. He likewise endeavours to account for their Formation, and to shew how well they are fitted for uniting the Laminæ of Bones without any Inconvenience\*.

This

---

\* The Claviculi may possibly be true ; but in Bones prepared as he directs, I could never be able to see more than numerous irregular Processes

This spongy cavernous internal Part of the Bones is generally called their Cancelli, or Lattice-work, and formed in the following Manner. The Laminæ are firmly joined about the Middle of the Bone; but as they are extended towards its Extremities, the more internal Laminæ separate from the exterior, and stretch out their Fibres towards the Axis of the Bone, where they are interwoven with the Fibres of other Laminæ that have been sent off in the same Way; and seeing the Laminæ are thus constantly going off in their Course towards the Extremities, the solid Sides of the Bone must become thinner proportionably, and the Lattice-work must be thicker and stronger. This is seen evidently in some Bones, where the solid Walls or Sides are no thicker than Paper, and the Cancelli are numerous, and large enough to fill up the whole Space left between the Sides.

The Twistings and Windings which these Cancelli make, and the Interstices which they leave, differ considerably in Figure, Number, and Size; and therefore form little Cells, which are different, but communicate with each other \*.

The Cancelli sustain the membranous Vessels of the Marrow, which are stretched upon them, and thereby hinder these membranous Parts to be torn or removed out of their proper Places, in the violent Motions, and different Postures which the

Processes rising out from the Laminæ; and the accurate Discoverer of the minute Structure of Animals, MALPIGHIUS, thinks these nothing else than some few of the bony Fibres rising perpendicularly, while the greatest Number run horizontally, and denies them to have any such regular Appearances as GAGLIARDI describes.

\* GAGLIARDI minutely remarks these different Appearances of the Cancelli, after they begin to separate from the Laminæ, and from thence distinguishes them into Cancelli *corrugati* or wrinkled, *Cribriformes* or perforated and *Reticulares*.

Bones are employed in, or in the several Degrees of Distention which the Vessels are brought to, by the Increase or Decrease of the Quantity of Marrow. This Support which the Cancelli afford the Marrow, also saves the Membranes and Vessels of this Substance, in the inferior Parts of the Bones, from being compressed by the Weight of the Marrow in their middle and superior Parts, which would make a considerable Pressure in the long perpendicular Bones.

The Depressions between the Fibres of the exterior Laminæ of Bones appear like so many Furrows on their Surface, into each of which the Periosteum enters, by which the Surface of Contract between it and the Bone is considerably increased, and a greater Number of Vessels is sent from it into the Bone. On both these Accounts the Adhesion is stronger than it would be, if there was less Surface of Contract and fewer Vessels.

Both on the Ridges and Furrows, numerous little Orifices or Apertures are to be seen, by which the Vessels pass to and from the Bones \*.

The

---

\* After a successful Injection, the Arteries can be traced in their Course, from the Apertures to the Laminæ and Fibres; and in sawing, cutting, or rasping the Bones of living Creatures, these Vessels discover themselves by the small Drops of Blood which then oze out from the most solid Part of Bones. But the clearest Demonstration of the intimate Distribution of these small Arteries, is, to observe the Effect of such a tinging Substance as can retain its Colour, when swallowed, digested, and mixed with the Blood of any living Animal, and at the same Time has Particles small enough to be conveyed into the Vessels of the Bones, such is Tincture of Madder-Root, gradually tinging their Periosteum into the more internal Parts of the Bones; and how universally the Distribution of the Liquors is made, the whole bony Substance being tinged. Whether the Time which this tincturing Liquor takes to pass from the exterior to the internal Laminæ, till all are made of its Colour; and the Time which the Disappearing of the Dye, after giving the Creature

The Arteries of the Bones are larger near each Extremity than at the Middle of the larger Bones that are much moved, because they not only serve the bony Laminæ near the Extremities, but pass through them to the Marrow. As Animals advance in Age, the Arteries of the Bones become less capacious, as is very evident : First, From the Bones of Adults having less Blood in them, than those of Children. Secondly, From their becoming incapable in old Age of admitting the Colouring in Injections, which easily pass in Youth. And, Lastly, From the Bones of old Creatures being more difficultly tinged with Madder than those of young Subjects.

As the Veins of the Periosteum cannot be filled with Injection, we are not to expect that their Branches, the Veins of the Bones, should ; as they are to be seen distinct and minute ; but we may conclude from Arteries being accompanied with Veins and Nerves \*, so far as we can trace them in every other Part of the Body, that there are also Veins in the Bones ; and the disappearing of the Tincture of Madder could not be without them †.

From

no more of this sort of Food, makes us think it takes to return, are the same which the natural Liquors may circulate, is uncertain ; because this tinging Substance may not be so fit for circulating in the Vessels, as the natural Liquors are.

\* If the Authors be not mistaken, the Arteries of Bones have sometimes become very large. DIEMERBROECK relates an Observation of an Artery in the anterior middle Part of a carious Tibia, the Pulsation of which he saw evidently for some Days ; and MERY demonstrated to the Royal Academy at Paris, a large Artery passing through a solid hard Bone.

† As the Nerves cannot be distinctly shewn by Dissection ; whence it might be inferred that they have no Nerves distributed to them, but the general Tenor of Nature, which bestows Nerves to all the other Parts, should prevent our drawing such a Conclusion : And if Sensibility is a sure Proof of Nerves entering into the Composition of any Part of the Bones ; for the granulated red Flesh which spouts out from them, after an Amputation of

From what has been said of the Vessels of Bones, it is evident that there is a constant Circulation of Fluids in every Part of them, and that there is a perpetual Waste and Renovation of the Particles which compose the solid Fibres of Bones, as well as in other Parts of the Body; the Addition from the Fluids exceeding the Waste during the Growth of the Bones, the Renewal and Waste keeping pretty near Par in Adults of middle Age, and the Waste exceeding the Supply from the Liquors in old Age, as is demonstrable from their Weight; for each Bone increases in Weight as a Person approaches to Maturity, continues of nearly the same Weight till old Age begins, and then becomes lighter. The specific Gravity of the solid Sides, on the contrary, increases by Age; for then they become more hard, compact, and dense. In consequence of this, the Bones of old People are thinner and firmer in their Sides, and have larger Cavities than those of young Subjects.

Viewing the internal Surface of the solid Bones, we see the Orifices or Canals, which pass exteriorly through the Laminæ, to open into other Apertures that are in a longitudinal Direction, from which other transverse Passages egress to terminate in other longitudinal Canals, and this Structure is continued through the whole Substance of the Bone,

an Extremity, or performing the Operation of the Trepan, or after an Exfoliation, is exquisitely sensible: and in some Caries, where the Periosteum was separated, the Patient suffered racking Pain, if the Bone was touched with a rough Instrument; nor was he free of Pain after the Bone was perforated. The Reason why the Nerves of rigid hard Bones become insensible, is, that all Nerves must have a considerable Degree of Flexibility at the Part where Objects are applied, otherwise they cannot be affected by the Impressions of Objects. We see this illustrated in a very common analogous Case, the Growth of a new Nail; when the former one has suppurated off, the thin Membrane which first appears is exquisitely sensible, but gradually becomes dull in its Sensation, till it can be cut or scraped without causing Pain, when it is formed into a hard Nail.

both

both these kinds of Canals becoming gradually smaller as they approach the external Surface. These Canals may be easily seen in calcined Bone; when broken transversely, the Orifices of the longitudinal Canals are in View; and, when we separate the Laminæ, the transverse ones are to be observed. Here, however, we are not to make these Sorts of Canals more numerous than they really are, because, as MORGAGNI has remarked, the Foramina made by the transverse Processes connecting the Laminæ of the Bone, will have the Appearance of the transverse, and the Passages for the Blood-vessels resemble the longitudinal Canals. However, the transverse Canals may be distinguished between the two Kinds of longitudinal ones; those for the Passages of the Vessels are largest near the external Surface of the Bone, and every transverse Section of them is circular; whereas the longitudinal Canals are largest near the Cancelli, and their transverse Sections appear to me to be of a flat oval Figure, which may be owing to the different Momentum of the Fluids conveyed into them. The Situation of the larger Vessels makes a Bone appear more dense and compact in the Middle of its solid Sides, than towards its outer and inner Surfaces, where it is spongy.

\* This vascular Texture of Bones must make them subject to Obstructions, Ecchymoses, Ulcers, Gangrenes, and most other Diseases which the softer Parts are affected with; and therefore there may be a greater Variety of Caries than is commonly described. Hence we can account for the following Appearances:

Hæmorrhages from spongyous Flesh rising out from the most solid Part of a cut Bone.

The regular alternate Elevation and Subsiding, or apparent Pulsation, so frequently to be seen in some of the Cells of a carious Bone.

Cells resembling Cancelli, sometimes seen in the Part of a Bone, which in a natural State is the most solid and firm.

A Bone calcinated as a Tube, including another within it.

We see Marrow contained in the larger transverse and longitudinal Canals just now described, and from thence judge that it passes also into the smaller ones. The Drops of Oil which we discover with a Microscope every where on the Surface of a recent, transverse, fractured Bone, and the ouzing of Oil through the most solid Bones of a Skeleton, which renders them greasy and yellow, are a Confirmation of the Use of these Canals. Of what Advantage this Distribution of the Marrow through the Substance of Bones is, will be pointed out, after the Nature of this animal Oil has been inquired into.

The spongy Substance appears clearly enough to be made up of irregular Portions, or Fragments, of both the internal Laminæ, and of the Extremities of all that are between these and the exterior.

These Portions of Laminæ appear, in some Places, to have something of a regular Disposition; for, from the Middle of the Bone to its superior Extremity, the Fragments from the external Laminæ follow nearly the same Direction with the Laminæ themselves; but in those that lie more internally, and are consequently shorter; these Laminæ gradually leave the Circumference of the Bone, and turn towards its Axis, or that Line which may be imagined to run in the Middle of the Bone through its whole Length. From this Disposition they seem to form several Hives, placed one upon another, the small Distances left between them being filled by another numerous Order of little Laminæ, situated some more, some less, transversely.

Below the middle of the Femur, and towards the inferior Extremity, the Fragments are more disposed according to the Length of the Bone; and Laminæ, which fill up the Spaces between them, are more transverse: It may be re-  
marked



marked likewise, that these Laminæ in many Places, and principally towards the Ends of the Bone, seem to degenerate into small Filaments of different Sizes; which, together with the Laminæ from which they arise, represent a kind of Sponge.

In the cellular Substance of both Ends of the Bone, some Marks of the original Union of its Epiphyses are often to be seen. In Children, each of these Marks has a thick Stratum of cartilaginous Matter, which, as they grow up, becomes gradually thinner and harder, and at length ossifies. In many Subjects, these marks are totally effaced, the Epiphyses then becoming true Apophyses, or, at least, inseparable from the Body of the Bone, as Apophyses are. In other Subjects, this Ossification remains long without being completed; and thus the Epiphyses may be, either by Art or Accident, loosened and parted from the Bone.

The Femur furnishes us with an Example, not only of the three different Substances in Bones, but also of the different Kinds of internal Cavities; we see one large cylindrical Cavity, through the whole Length of its middle Part; also numerous lesser Cells of various Figures and Dimensions, formed in the Interstices of the cellulous Substance in both Extremities; and, lastly, little Apertures in the Interstices of the reticular Substance, where the Filaments are mingled with the Laminæ in the spongy Part. We may likewise observe the small Ducts, which are either distributed through the Substance of the Bone, or penetrate it all the Way to the Marrow. The Existence of the invisible Pores is likewise demonstrated, through which the Marrow transudes, being first conveyed through the whole Thickness of the Bone.

The Substance of Bones examined chymically by the Retort, will afford \* Spirit, Water, Salt, and Oil. After which, there remains in the Retort, a small earthy Substance, retaining only the exact Figures of the Bones employed, but very friable; and the Spirit produced from them may be rectified, or separated into Water, Salt, and Oil.

Hence it appears, that Bones are composed of four Principles or Elements; therefore they are the most proper Materials for forming Vessels, that are to undergo the greatest Force of Fire, being scarce capable of vitrifying, which other Substances are very liable to. This Earth would seem to be the proper constituent solid Part of Bones; for the Quantity of it is great, greater, says HAVERS, than all the other Principles taken together; and after all the others are separated from a Bone, its former Shape still remains, though it becomes so friable as to moulder into Dust on the least Touch; and when moistened with a little Water or Oil, it recovers some Degree of Tenacity, but can never be restored to its former Firmness; since it is not possible by any Art, to reduce Bones to their natural State, when once they are changed, and have their several Principles separated by a chymical Analysis.

Therefore the Solidity of Bones increases by Age, in Proportion of the terrestrial Particles becomes greater, while some of these degenerate from their State; whence we may judge why the Bones of old People are more friable than those of young ones.

Though the Bones so far agree in their Structure and annexed Parts, yet we may observe a considerable Difference among them in their Magni-

---

\* This succeeds best with the Bones of Infants.

rude, Figures, Situation, Substance, Connection, Uses, &c. from which Authors have taken occasion to divide them into as many different Classes. But these being so obvious to ocular Inspection, I shall content myself with mentioning only one of them; which, as it is at first Sight very remarkable, so it comprehends very near the whole Bones of the Body, and at the same Time leads us to examine the most considerable Variety that is to be found in the Disposition of their constituent Parts and in their Uses, which is, that some Bones are broad and flat, while others are long and round.

The broad Bones have thin Sides as the Laminæ, being soon and equally sent off to form the Cancelli; and this Lattice-work is thicker, and nearly of an equal Form throughout. By this Structure they are well adapted to their Uses, to afford a Surface large enough for the Muscles to rise from, and move upon, and defend the Parts which they inclose.

The round Bones have thick strong Walls in the Middle, and become very thin towards their Ends; which is owing to some few Laminæ separating at their Middle, and, on that Account, the Cancelli are so fine and small, that they are not taken notice of: But such Bones are said to have a large Reservoir of Oil in this Place. Towards their Extremities, the Cancelli become very thick, and rather more complete than in the other Sort of Bones. These round Bones are naturally very strong, and being exposed to violent Injuries, have need of a cylindrical Figure to resist external Pressure, and of a considerable Quantity of Oil to preserve them from becoming too brittle. Besides which, they are advantageously provided with thick Sides towards their Middle, where the greatest Force is applied to injure them; while their

Hol-

Hollowness increases their Diameter, and consequently their Strength to resist the Violence applied to break them transversely, as has been demonstrated by GALILÆUS. Thus, for instance, in estimating the proportionable Resistance of two cylindrical Bones of unequal Diameters, but consisting of an equal Number of similar Fibres uniformly disposed round each, it is plain :

1. That the absolute Force of these two Bones is equal, because they consist of equal Numbers of similar Fibres.

2. That the absolute Force of all the Fibres in each Bone will have the same Effect in resisting any Power applied to break them, as if the Sum of all their Forces was united in the respective Centers of the transverse Sections where the Fractures are to be made. For by Hypothesis, the Fibres being uniformly disposed in each, there is not any Fibre in either Bone that has not a corresponding Fibre ; the Sum of both whose Distances from the Axis of Renovation (about which all the Parts of the Bone must revolt in breaking) is equal to two Semidiameters of the Bone : Consequently each Fibre, and all the Fibres, may be regarded as resisting at the Distance of one Semidiameter or Radius from this Axis, that is, in the Center.

3. Since the united Force of all the Fibres is to be regarded as resisting at a Distance from the Center of Motion equal to the Semidiameter, it follows that the total Resistance of all these Fibres, or the Strength of the Bone will be proportionable to its Semidiameter, and consequently to its Diameter.

I have here taken for an Example one of the most simple Cases for calculating the proportionable Force

Force of Bones ; but was it not too foreign to the present Design, it might be universally demonstrated, that of whatever Figure Bones are, and in whatever Manner their Fibres are disposed, their Strength must always be in a Ratio compounded of the Area of their transverse Sections, or of their Quantity of bony Matter, or of the Distance of the Center of Gravity of these Sections from the Center of Motion, or Fulcrum, on which the Bone is supposed to be broken.

Since therefore the Strength of Bones depends on their Number of Fibres or Quantity of Matter, and the Largeness of their Diameters, one may conclude, that the Part of a Bone formerly fractured, and reunited by a Callus, must be stronger than it was before the Fracture happened ; because both these Advantages are obtained from the Callus : Which is a wise Provision, since Bones are never set in such exact a Direction as they were naturally of ; and then wherever a Callus is formed, there is such an Obstruction of the Vessels, that if the Bone was again broke in the same Place, the ossific Matter could not so easily be conveyed to reunite it. This Callus may indeed, for want of Comprehension, be allowed to form a spongy cellular Substance, as Ruyssch says, he has sometimes seen it ; but even in this Case the Strength of the Bone at this Part would be still increased by one or both the Causes above-mentioned.

However solid and compact adult Bones are, yet they were once Cartilages, Membranes, nay a mere Gelly. This needs no further Proof, than repeated Observations of Embryos when dissected : And how much more tender must the Bones be before that Time, when neither Knife nor Eye is capable to discover the least Rudiments of them ? By degrees they become more solid, then assume  
the

the Nature of Cartilage, and at last ossify. The Cohesion of their Laminæ and Fibres always increasing in Proportion to their increased Solidities, as is evident from the Time necessary to unravel the Texture of Bones of People of different Ages, or of dense and spongy Bones, or of the different Parts of the same Bone, and from the more tedious Exfoliations of the Bones of Adults than of Children.

The Induration of Bones is chiefly owing to their being exposed more than any other Parts to the strong Pressure of the great Weights they support, to the violent Contraction of the Muscles fixed to them, and to the Force of the Parts they contain, which endeavour to make Way for their own further Growth. By all this pressing Force the solid Fibres and Vessels of the Bones are thrust closer, and such Particles of the Fluids conveyed in these Vessels as are fit to be united to the Fibres, are sooner and more firmly incorporated with them, while the remaining Fluids are forcibly driven out by the Veins to be mixed with the Mass of Blood. In consequence of this, the Vessels gradually diminish as the Bones harden. From which again we can understand one Reason, why the Bones of young Creatures sooner reunite after a Fracture, than those of old; and why Horses, Bulls, and other Creatures, whose young are numerous, decay in their Size, when put too soon to hard Labour.

That the ossifying of Bones greatly depends on Pressure, seems to be evinced from the frequent Examples we meet with of other Parts turning bony, when long exposed to the compressing Force of the surrounding Parts, or when they are subjected to the like Circumstances by their own frequent and violent Contraction. Witness Bones frequently found near the Base of the Heart in  
some

some old Men, and in several other Creatures; nay, the muscular Substance of the Heart has ossified and the Arteries of old Men often become ossaceous. The Cartilages of the Larynx are generally ossified in Adults. In Beasts of Burden the Cartilages between the Vertebrae of the Back very often change into complete Bones, and being intimately united with the Vertebrae, the whole appears one continued Bone. Nor is the Periosteum exempt from such an Induration; for PEYER tells us, he divided this Membrane into several bony Laminæ.

To confirm this Argument still further, we may observe, That Bones begin their Ossification at the Places where they are most exposed to these Causes, viz. in the cylindrical Bones from a middle Ring, and in the broad ones, at or near their Center, from one or more distinct Points. The Reason of which is, that these Parts are contiguous to the Bellies of the Muscles annexed to the Bones, where the Swelling of these moving Powers is greatest. What the Effects of this may be, let any judge who view some of the Bones, as the Scapula and Offa Ilium, which are covered with Muscles on each Side; how compact and thin they are in Adults, where the Bellies of the Muscles were lodged; whereas in Children they are thicker. But this being the middle Part of these Bones, where the greatest Number of Fibres is, this particular Place would have been much thicker in Adults, had not this forcible Cause been applied, which has not had such Effects in Children, whose Muscles have not been much exercised. Besides, if we allow that all the Parts of a Bone are equally increased by the constant Supply of new Particles, each Fibre, and every Particle of a Fibre, will endeavour to make Way for its own Growth, by pushing the one next to it; and consequently by far

far the greatest Pressure will be on the Middle : Wherefore the Particles there will be made most firm : And here it is that Bones begin their Ossification. Lastly, the Pulsation of the medullary Arteries, which enter the Bones near to this middle Part, may, as Authors have alledged, contribute perhaps somewhat to this Induration.

From the Effects of Pressure only it is, that we can account for the Bones of old People having their Sides so much thinner, yet more dense and solid, while the Cavities are so much larger than in those of young People ; and for the Impressions of Muscles, Vessels, &c. being so much more strongly marked on the Surfaces of the former than of the latter, if they belong to People of near the same Condition in Life. Pressure must likewise be the Cause which in People of equal Ages makes these Impressions stronger in the Bones of those who have had much Labour and Exercise, than they are found in People who have led an indolent unactive Life.

It is also probable, that Ossification depends on the Vessels of the Bones being so disposed, and of such Diameters, as to separate a Liquor, which may easily, when deprived of its thinner Parts, turn into a bony Substance ; as seems plainly from the Observation of the cellulous Matter separated after Fractures and Ulcers, where Part of the Bone is taken out : For in these Cases this Liquor oozing out from the open Orifices of the lacerated Vessels is gradually formed into granulated Flesh ; which extends itself so as to fill up all the Space where the Bone is taken from, then hardens, till it becomes as firm as any other Part of the Bone. This happens frequently, even when the Ends of the diseased Bone are at a considerable Distance from each other, as several Cases, and  
of



of which there are remarkable Instances handed down by Authors.

Perhaps both the Causes of Ossification above-mentioned, may be assisted by the Nature of the Climate live in; and the Food they use. Whence, in hot Countries, the Inhabitants sooner come to their Height of Stature, then in the northerly cold Regions: And thence seems to have arisen the common Practice among the Ladies of making Puppies drink Brandy, or Spirit of Wine, and of bathing them in these Liquors, to prevent their growing big. Nay, it has been observed, that much Use of such Spirits has occasioned Parts, naturally soft, to putrify in some, and to ossify in other People of no great Age. Witness the Cases related by LITTRE and GEOFFROY \*.

From the foregoing Account of the Structure of Bones, and of their Ossification, we may understand the Reasons of the following Phænomena:

How Bones may be softened or dissolved.

How the natural Colour of the Bones may be changed by some sorts of Food.

Why the Bones of some People are so long in hardening, and in others never compleatly indurate.

Why in such whose Ossification is very slow, the Bones are generally thicker in Proportion to their Lengths, especially at their Extremities, as in the Rickets.

How hard firm Bones are become soft and pliable by Diseases.

How in some Cases the Bones may waste and diminish.

How the Bones may become solid all through, without any Appearance of Cancelli.

Why the Epiphyses separate from the Bones in some Diseases.

---

\* Memoires & Hist. de l'Acad. des Sciences, 1706.

How Nodes, Tophi, and Exostoses happen after the Erosion of the external Laminæ of the Bones in the Lues Venerea, Scurvy, Rheumatism, and Gout.

What occasions sometimes such Difficulty in curing fractured Bones, or why they never reunite, tho' they are reduced, and all proper Means towards a Cure are used.

Why Calluses, after Fractures, are sometimes very thick and protuberant.

What Difference there ought to be in the Application of Bandages to Fractures of old and young Subjects \*.

The Marrow is of very considerable Use to the Bones ; for by entering their transverse Canals, and passing from them into the longitudinal ones, which is communicated to all the Laminæ, to soften and preserve them from becoming too brittle ; and consequently the Bones are kept stronger to resist Injuries. How far this Oil contributes to the Firmness of the Bones, is sufficiently demonstrated, by observing their Brittleness, when it is consumed, or loses its oleaginous Consistence, as in scorbutic pocky Subjects, in old People, or in such Bones as have been deprived of this Oil by Fire or otherwise.

Besides this Advantage which the Substance of the Bones has from the Marrow, their Articulations are said to receive no less Benefit ; for there are

\* Whoever is desirous to know in what Time and Order each Bone and its several Parts begin to assume a bony Nature, let him consult KERCKRINGIUS, who gives us the Delineations of Abortions from three Days after Conception, and traces the Ossification of the Bones from three Weeks and a Month, till the Time of the Birth : To whom should be added COITERUS and EYSSONIUS. An Account of this Subject might also be collected out of RUYSCH's Works, where some of the Mistakes committed by the former Authors are corrected, and several more Particulars to make the History of the Osteogenea more accurate, have since been added by NESBITT and ALBINUS.

several Apertures near the large Articulations, which communicate with the medullary Cells, and transmit the Oil to the Articulations, as is evident from the Marrow found often congealed in those Pores of fat Animals. Then, all the Parts concerned in the Motion of the Joint will be lubricated; and when the Mucilage secreted here, (to be afterwards described) is incorporated with the Oil, one of the most effectual Mixtures is formed for such a Use \*.

When the Marrow, after having served for the Uses mentioned, is reassumed in the Mass of Blood, (as it is continually, in common with all the other secreted Liquors that have not Passages formed for conveying them out of the Body) it corrects the too great Acrimony communicated to the saline Particles of our Fluids, by their Circulation and Heat; in the same Manner as the lixivial Salts are blunted by Oil in making Soap. Hence in acute Diseases, the Marrow, as well as the other oleaginous Substances of the Body, is quickly wasted †.

\* The Quantity of this Liquor supplied to the Articulations, is always in Proportion to the Quantity of Motion performed by the Joints; and hence by Exercise or Labour, the Quantity of Marrow is diminished; so that Butchers can tell, by looking at the Bones of slaughtered Beasts, whether they have lately come off a Journey, or no.

† As the Nature of all Oil is to become thin and rancid, when exposed long to Heat, we may thence, and from the Structure of the Bones, see why such an ungrateful Smell and black thin Ichor proceed from corrupted Bones, rather than from any other Part of the Body; and can understand the Reason of the Changes of Colour which Bones undergo, according to their different Degrees of Mortification. Hence, likewise, we may learn the Cause of a Spina venetosa, and of the Difficulty of curing such Caries of Bones as proceed from an Obstruction, and consequently Putrefaction of the Marrow, and of a quick Pulse, Thirst, and hectic Paroxysms so often attending these Diseases in the Bones. And from these Phenomena we may deduce the Reason of the fatal Prognosis taken from black foetid Urine in Fevers.

Of the MARROW and MEDULLARY MEMBRANE  
of the BONE.

The greatest Part of the Bones contain in their Cavities or Cells an unctuous fat Substance of a solid Consistence in some, and soft in others. It is called by the general Name of Marrow, especially that which lies in the large Cavities of the long Bones. That which is dispersed in the small cellulous Cavities is likewise called the Medullary Juice.

The Marrow is a Mass, composed of an Infinity of fine Vesicles or membranous Cells joined together, and communicating with each other, furnished with Blood-Vessels and Nerves, and filled with a fine sweet aleaginous Matter, secreted from the Blood.

All these Cells or membranous Vesicles are surrounded by a very fine Membrane, which is like an internal Periosteum, sticks close to the interior Surface of the Bone, by means of an infinite Number of capillary Vessels, and of several other kinds of very small Filaments. The reticular Substance of the Bones runs through this medullary Mass, and as it were interlards it, and by this means sustains it in the middle of the great Cavities.

The Marrow of the cellulous or cavernous Substance of Bones is divided by small osseous Septa or Laminae, and by the Filaments of the reticular Substance of Bones, into a vast Number of Vesicles or membranous Cells which line the osseous Cells, and communicate with each other. This Cellular in the cavernous Texture of Bones differs from that in the great Cavities both in Colour and Consistence. It is liquid, and almost quite of a red Colour, whereas the other is much more solid, and is often of a red Colour only on it's Surface.

The

The Difference is owing to the sanguiferous Vessels which run through each membranous Cell; whereas the Marrow in the great Cavities seems to be furnished with them in the common Membrane only. Many of those medullary Cells are likewise divided by the bony Filaments of a cavernous Substance, and these small Filaments, as well as those of the reticular Texture, are inclosed by Portions of the medullary Membrane, as an internal Periosteum \*.

But it is to both these Substances taken together, that Anatomists give the Name of Marrow, not to either of them taken singly. The medullary Membrane is very sensible, but not the Juice, which is necessary to be observed to understand what is meant by the Sensibility of the Marrow †.

The sanguiferous VESSELS of the BONES, and their Appendices.

They may be reduced to three Classes. Some go to the external Parts of Bones, to the Ligaments, Cartilages, mucilaginous Glands, and Periosteum. Others penetrate the Substance of the Bone, and the third Kind goes all the Way to the internal Cavities, and is distributed to the medullary Membrane, and disposing the oleaginous Particles from the Blood, makes what is called Marrow.

The Vessels of the first Class, that is, those spread on the external Parts of Bones, are the Ramifications

\* The medullary Membranes may be separated from the Liquor which they contain, by steeping the whole Mass in very hot Water, and afterwards compressing it by gentle Degrees.

† We may imitate the Fat or Marrow of any Animal, by taking Oil of Olives, and pour it upon Spirit of Nitre; then digest them for some Days. By degrees the Oil becomes of the Colour of Marrow, and at last is congealed or hardened into a white Fat, as that of any Animals. Hence it appears, that animal Fat, or Marrow, is but coagulated of the oleaginous Particles of the Blood.

of those which go to the circumjacent Muscles, and other Parts contiguous to the Bones. The greatest Number of them go to the Periosteum, and run in between its different Laminæ, being divided into an infinite Number of capillary Ramifications, disposed in a reticular Manner by their frequent Communications. [I shall not here take upon me to determine whether this Membrane has any particular elastic Force, by which it can increase that of the sanguiferous Vessels.]

The Vessels of the second Class, or those of the Substance of Bones, are Productions or Continuations of those of the Periosteum, which enter the Pores of the Bones like very fine Filaments, and run longitudinally between the osseous Fibres. The Existence of these small Vessels are very evident in Fractures, especially in young People.

These Arteries and Veins do not here accompany each other as in other Parts of the Body, but run in opposite Directions till they meet. This Conjecture is founded on the different Obliquity of certain Foraminæ. It must not, however, be imagined, that all Arteries enter at one End of the long Bones, and that the Veins go out at the other; the Reunion of fractured Bones is sufficient to destroy this Opinion.

The Vessels that go to the inner Substance of the Bones, not only through the external Pores, but also through those of all the inner Cavities, both great and small, being detached from the medullary Membrane in the same Manner, as from the Periosteum.

These Arteries and Veins of this Class often accompany each other as they pass through the Bones, and sometimes each passes through a separate Aperture.

Those of the first Class serve chiefly to nourish the external Parts of the Bones, and to furnish the

mucilaginous Glands with the Liquor secreted in them. Those of the second Class furnish the nutritious Juice of the internal Substance of the Bones. Those of the third Class come likewise from the Periosteum. They appear to be destined chiefly for the Formation of the Marrow and medullary Juice, and are spread in great Numbers over the Membranes of each. They enter the Cavities of the concave Bones through the oblique Orifices in their solid Substance, and into the Cells by other small Apertures; ramifying themselves in all Directions, not only on the Membranes of the Marrow and medullary Juice, but likewise through the Substance of the Bones in their Passage to the internal Cavities.

#### Of the CARTILAGES.

A Cartilage is a whitish or pearl-coloured Substance, which covers the Extremities of Bones joined together by moveable Articulations, increases the Volume of some of them after the manner of Epiphyses, unites others very closely together, and has no immediate Adhesion of Connection with others.

Cartilages are solid, smooth, white, elastic Substances, between the Hardness of a Bone and Ligament; and covered with a Membrane named Perichondrium, which is of the same Structure and Use as the Periosteum, but not so sensible.

The Cartilages are formed of Laminæ much of the same Nature of some Bone; its Cohesion differs in various Parts, and have no Cancelli, more tender and less friable than that of Bones; they are pliable and elastic, but with Age they sometimes grow so hard as to ossify.

Cartilages are subject to Exfoliation, as well as Bones: We best see their Structure, by boiling or exposing them to the Weather.

The Cartilages which unite to the Bones are of four Kinds.

Some cover both Sides of the moveable Articulations, and are very smooth and slippery.

Some unite the Bones to each other, either so firmly as to allow no sensible Motion, as in the Symphysis of the *Ossa Pubis*, and still more in that by which the *Epiphyses* are joined to the Bones; or in such a Manner as to allow of different Motions, as in those by which the Bodies of the *Vertebræ* are connected. The first grow easily hard, the others appear in some measure viscid, and retain their Flexibility.

Some increase the Size and Extent of Bones. Of these again, some are articulated with other Bones, as the cartilaginous Portions of almost all the true Ribs; or with other Cartilages, as the *Septum Narium*; others serve only for Borders, as those of the Basis of the *Scapula*, and of the *Crista* of the *Os Ileum*, the *Supercilia* of Cavities, and those of the spinal and transverse Processes of the *Vertebræ*.

Some, in fine, have a singular Form, as those of the Ears, and most of those of the Nose; in which last, their Elasticity appears most sensibly.

The Cartilages belonging to the second general Class, or those not immediately joined to Bones, are, for the most Part, placed in moveable Joints; and may likewise be subdivided into several Kinds.

Some lie altogether loose, being joined neither to the articulated Bones nor to the Cartilages which cover them, but slide freely between them in different Directions; as those which are placed in the Articulation of the *Tibia* with the *Femur*; in that of the inferior *Maxilla*, with the *Ossa Temporum*;



porum; and in that of the Clavicle with the Sternum. These between the Clavicle and Acromium, and between the first and second Cervical Vertebrae are of the same Kind. Some partly joined to other Cartilages, and partly slide between the cartilaginous Extremities of the articulated Bones, as the Cartilage at the inferior Extremity of the Radius.

We might likewise reckon among the Cartilages, though more improperly, several of the small sesamoide Bones which remain long cartilaginous, and also the cartilaginous Portions of Tendons, which do the same Office with sesamoide Bones.

The Cartilages are composed of Laminæ disposed much in the same Manner as those of the Bones, as might be reasonably concluded from observing Bones in a cartilaginous State before they ossify; and from seeing so many Cartilages become osseous: This may be still farther confirmed, by the Exfoliation which Cartilages are subject to, as well as Bones; and a Demonstration can be given of their Structure, after boiling, burning, or exposing them to the Weather.

While Cartilages are in a natural State, it is to be remarked; First, That they have no Cavity in their Middle for Marrow. Secondly, That their exterior Surface is softest, which renders them more flexible; from this it is, that injected Liquors easily fill the Vessels on their Surface, but seldom reach to their middle solid Part. And Lastly, That as the specific Gravity of Cartilages is near a Third less than that of Bones, so the Cohesion of their several Laminæ is not so strong as in Bones; whence Cartilages laid bare in Wounds or Ulcers, are more liable to corrupt, and exfoliate much sooner than Bones.

Cartilages seem to be principally kept from ossifying, either by being subjected to alternate Motions

tions of Flexion and Extension, the Effects of which are very different from any kind of simple Pressure, or by being constantly moistened; thus the Cartilages on the articulated Extremities of the great Bones, and the moveable ones placed between the moving Bones in some Articulations, which are obliged to suffer many and different Flexions, and are plentifully moistened, scarce ever change into Bone, while those of the Ribs and Larynx are often found ossified. The middle angular Part of the Cartilages of the Ribs, which is constantly in an alternate State of Flexion and Extension, by being moved in Respiration, is always the last becoming bony. In the Larynx, the Epiglottis, which is oftener bended and more moistened than the other four Cartilages, seldom is ossified, while the others as seldom escape it in Adults.

The Cartilages begin to ossify on their external Surface, unless when Moisture or Flexion impede it; and the Ossification proceeds internally till the Cancelli are at last formed, when a sort of Marrow is deposited into them: While this Change is bringing about in the Substance of the Cartilages, their Blood Vessels gradually appear bigger towards their internal Substance, and less on the external.

The Cartilages, being naturally of such firm Substance, and of a Composition akin to the Bones, will gradually acquire greater Solidity by constant Pressure; and this Change will be made soonest and most remarkably, where the Pressure is greatest, that is, at their external Surface. The exterior Laminæ, when ossified, are more compact and dense than formerly, and therefore they will have a stronger Power of attracting those in Contract with them; while the Branches of Vessels distributed to the first ossified Lamella, and those  
that

that run in the Interstices of the Fibres of this and the Laminæ next to it, being now more compressed than formerly, will have a less Quantity of Fluids passing through them, and consequently the other Branches will receive a proportionably larger Quantity; the Momentum of which, joined to that Power of Attraction or or Force of Cohesion, increased by the greater Solidity of the Laminæ, will increase the Pressure upon more internal Laminæ, and hasten their hardening; after which, these last Laminæ will produce the same Effects on the other contiguous to them: And thus the Ossification must go on till all are become osseous. The Body thus changed, will have its former Dimensions, or nearly so, because its external Part ossified first, and being rigid, yields little or nothing to the Powers that draw it towards the Axis of the Bone. But seeing the new Particles added from the circulating Fluids, during the Ossification, do not compensate for the Condensation which all the Particles undergo, and thereby the Laminæ occupy less Space than they did while in a cartilaginous State, a Cavity is left in the Middle. And as all the Laminæ cohere and have cross Fibres joining them, many of these Fibres are stretched irregularly from one Side of the Cavity to the other, and therefore form the Cancelli. The Branches of the Vessels formerly distributed to the Laminæ being now much lessened, the remaining Branches which run transversely, are frequently proportionably increased, become very conspicuous, and are dispersed every where in the Cavity, to serve for the Secretion of Marrow. Thus, this flexible elastic solid Substance becomes a rigid inflexible cavernous Bone with Marrow contained in its Cancelli.

The Cartilages subservient to Bones are, as CELSUS observes, sometimes found on the Extremities of those which are joined to no other; but are never wanting on the Ends and in the Cavities of such Bones as are designed for Motion: And in more than one Instance, Cartilages are interposed between such other Cartilages as cover the Heads and Cavities of articulated Bones; nay, they are also placed between immoveable ones.

The Uses of Cartilages, so far as they regard the Bones, are to allow, by their Smoothness, such Bones as are designed for Motion to slide easily without Detrition; while by their Flexibility they accommodate themselves to the several Figures necessary in different Motions, and by their Elasticity they recover their natural Position and Shape, as soon as the Pressure is removed. This springy Force may also assist the Motion of the Joint to be more expeditious. To these Cartilages we chiefly owe the Security of the moveable Articulations: For without them the osseous Fibres would sprout out, and intimately coalesce with the annexing Bone; whence a true Anchylosis must necessarily follow; which never fails to happen when the Cartilages are eroded, as already observed. The moveable Cartilages, interposed in Articulations, serve to make the Motions both freer and more safe than they would otherwise be. Those placed on the Extremity of Bones that are not articulated, as, on the Spine of the Ileum, Base of the Scapula, &c. serve to prevent the bony Fibres from growing out too far. Cartilages sometimes serve as Ligaments either to fasten together Bones that are immoveably joined, such are the Cartilages between the Os Sacrum and Os Ileum, the Os Pubis, &c. or to connect Bones that enjoy manifest Motion, as those between the  
Bodies

Bodies of the true Vertebræ, &c. Cartilages very often do the Office of Bones to greater Advantage than the last could ; as in the Brims of the Cavities, those of the Ribs, &c. Cartilages which supply Brims of Cavities, &c.

### THE LIGAMENTS OF BONES.

A Ligament is a white, fibrous, close, compact Substance more flexible than a Cartilage, not easily ruptured or torn, and which does not yield, or at least but very little, when pulled.

It is made up of very small and very strong Fibres, which by their different Texture and Disposition, form narrow Cords, broad or thin Membranes ; and these serve to bind, contain, limit, and defend the other Parts both hard and soft.

I am not here to speak of the Ligaments peculiar to the soft Parts ; but confine myself wholly to those which belong to Bones or Cartilages alone. Of these, we may establish two general Classes ; the first, containing those Ligaments which are of Use only to the Bones in which they are inserted ; the other, containing those which serve for other Parts besides the Bones in which they are fixed, and principally for the Muscles. If we have Regard to the Bones only, these last are improperly termed Ligaments, as not doing the Office of such, and consequently resembling the true Ligaments only in Texture.

Of those Ligaments which are fixed in Bones or Cartilages alone, and are not employed about the other Parts, some belong wholly to the Articulations or moveable Bones, and others have nothing to do with the Articulations.

The Ligaments which belong particularly to the moveable Articulations may therefore be called articular Ligaments, and are of several kinds.

Some

Some are designed only to fix and strengthen the Articulations, and secure the Bones in their different Motions, from parting from each other, as it happens in Luxations. These Ligaments are like Ropes, more or less flat, or like Membranes, sometimes narrow, and sometimes of a considerable breadth; and though some of them are thin, they are all very strong and yield but little. The Ligaments of the Articulations by Ginglymus, and those that tie the Bodies of the Vertebrae together, are of this kind.

Some contain a very fluid mucilaginous Liquor commonly called Synovia, which continually moistens the Articulations. These are not so properly Ligaments as ligamentary Membranes, bound immediately round the Articulations, and fixed to the Extremities of the articulated Bones, and thus forming Capsulae or Bags to contain that Liquor, and hinder it from running out.

These may very well be named Capsular Ligaments. They lie within the former sort, being closely united to their internal Surface, and are to be met with in all the moveable Articulations as in that of the Ulna with the Humerus, those of the Bones of the Carpus with each other, &c. but they are more like Membranes than Ligaments properly so called.

Some perform both the former Offices; that of a membranous Ligament to keep the Bones together, and of a Capsula to hold the Mucilage. These surround the orbicular Articulations, as that of the Humerus with the Scapula, of the Femur with the Os Innominatum, &c.

All the Parts of these Ligaments are not of equal Thickness, so that they appear to be made up of two kinds of Ligaments inseparably united or glued together; one Capsular which surrounds the whole Articulation, and several true Ligaments

ments extended to different Distances over the other, and closely united to it. The Name of Orbicular Ligaments is not general, because it does not agree to those of the Bones of the Tarsus, Carpus, &c.

I do not think it proper to rank among these, the membranous Vagina belonging to the Canal or Sinus in the superior Part of the Humerus, which shall be afterwards described.

Some are hid by the Articulations themselves and by the capsular Ligaments, as that belonging to the Head of the Femur, called improperly Ligamentum Teres, and the Crucial Ligaments of the Tibia.

The Ligaments which serve to connect Cartilages with Bones, might be reckoned another Species of articular Ligaments; and of these some are proper, as those belonging to the semilunar Cartilages of the Knee, to the cartilaginous Trochlea of the Orbit, &c. Others are common, as all those to which the inter-articular Cartilages are fastened by their Circumferences.

The other Ligaments of the first Class, or those fixed to Bones without any relation to the Articulations, are of two kinds.

Some of them are loose, and serve only to limit the Motions of Bones; such as those that tie the Clavicles to the coracoïde Apophyses; those that go from one Clavicle to the other, and those between the spinal Apophyses of the Vertebræ.

Some of them are tight, and stretched either between the Parts of the same Bone, as the Ligaments between the Acromium and coracoïde Apophysis, or between several Bones united together without Motion, as those that are fixed by one Extremity to the Os Sacrum, and by the other to the Os Ischium.

The

The Ligaments of the second general Class, or those which being fixed to Bones or Cartilages are likewise of Use to other Parts, are of two kinds. Some of them are fixed to Bones or Cartilages only, and some are likewise fixed to other Parts, or other Parts are fixed to them.

Those of the first Kind serve chiefly to inclose, check, limit, and strengthen the Muscles and Tendons, and sometimes to change their Directions.

The annular Ligaments are of this kind, and they antiently had their Name not so much from their Figure, as from their Use, which is much the same with that of the Rings through which the Reins of Horses pass; for it is after the same manner that these Ligaments bridle the Tendons of many Muscles, and thus hinder them from starting from their Places in violent Motions, and in some Circumstances, change their Directions.

The annular Ligaments are either particular and simple, or common and made up of several single ones, as we shall see in those of the Carpus, Thumb, &c. Some of them are like Vaginæ or Sheaths, as those on the internal or flat Side of the first and second Phalanges of the Fingers.

Some of them are only semiannular, as that of the superciliary Scissure of the Orbit, when there is a Ligament there, and that of the Scissure in the superior Costa of the Scapula.

To these might be referred the Ligaments between the Acromium and coracoïde Apophysis of the Scapula, and between the Os Sacrum and Os Ischium, which have been already mentioned in the first Class.

Those of the other kind which come under this second Class, comprehend the Ligaments fixed to other Parts as well as to Bones, and these again are of two sorts.

Some



Some of them are fixed to one or more Bones, with different Degrees of Tension; and serve on each Side for the Insertion of Muscles, supplying, in that respect, the Place of Bones.

Of this Kind are the interosseous Ligaments of the Fore-arm and Leg, the obturator Ligament; the Ligament extended on each Side of the Humerus, from the Cervix to the Condyles, the posterior and lateral Ligaments of the Cervix, and the ligamentary Membranes of the posterior Foramina of the Os Sacrum.

To these may be added the Ligaments commonly termed Aponeuroses; such as those of the Temples, Scapula, Humerus, Ulna, Palm of the Hand, Thigh, Leg, Sole of the Foot, &c. all which shall be described in their proper Places. And they may, in general, be termed Aponeurotic Ligaments, or ligamentary Aponeuroses, as Septa, ligamentary Vaginæ, &c. But they ought to be carefully distinguished from the aponeurotic Membranes of the Muscles and Tendons, which shall be mentioned hereafter. The Ligamentum Suspensorium of the Musculus Styloglossus belongs to this Class.

Other Differences of Ligaments may be deduced from their Consistence, Solidity, Thickness, Situation, and Figure, as we shall demonstrate.

Some Ligaments are almost cartilaginous, as those which surround the Head of the Radius, and the small Head of the Ulna, a Portion of the orbicular Ligament of the Head of the Femur, and the annular Virginæ of the Fingers.

Some of them have a particular Elasticity; by which they are capable of being drawn out by a sufficient Force, and of contracting again when left to themselves. This Elasticity differs from that of Cartilages, which last is hardly perceivable, but by compressing or bending them to a

certain Degree. It differs likewise from that of the other Ligaments, being not only very considerable in living Bodies, but even remains such after Death.

Of this Kind are the Supercilium of the Cotyloid Cavity, the Ligaments which tie the Os Hyoides to the Styloid Apophysis, the posterior cervical Ligament; the Ligaments which connect the sharp Edges of the spinal Processes of the Vertebrae to one another, and those seated at the Bases of these Apophyses next the great Canal of the Vertebrae, especially in those of the Lumbar \*.

The Arteries of Ligaments are very conspicuous after a tolerable Injection, and the Branches of their Veins are sometimes to be seen full of Blood.

Such Ligaments as form the Sides of Cavities, have numerous Orifices of their Arteries opening upon their internal Surface which keep it always moist: If we rub off that Moisture, and then press the Ligament, we can see the Liquor oozing out from small Pores, and we can force thin Liquors injected by the Arteries into the Cavities formed by Ligaments.

These exhaling Arteries must have corresponding inhaling Veins, otherwise the Cavities would soon be too full of Liquor.

The Ligaments which serve to connect the moveable Bones, commonly rise from the Conjunction of the Epiphyses of one Bone, and fall into the same Place of the other; or where Epiphyses are not, they are fixed to the Cervix, beyond the Supercilia of the articulated Bones;

\* After Maceration in Water, the Ligaments can easily be divided, and each ligamentous Stratum appears composed of Fibres, the largest of which are disposed in a longitudinal Direction.

and after such a Manner in both Cases, as to include the Articulation in a Capsula or Purse, with this Difference, depending on their different Motions, that where the Motion is only to be in two Directions, the Ligaments are strongest on those Sides towards which the Bones are not moved; and when a great Variety of Motions is designed to be allowed, the Ligaments are weaker than in the former Sort of Articulations, and are nearly of the same Strength all round.

Besides these common circular Ligaments of the Joints, there are in several Places particular ones, either for the firmer Conjunction of the articulated Bones, or for restraining and confining the Motion to some Side; such as the cross Ligaments of the Femur round it, &c \*.

Ligaments are also of Service to the Bones in several other Respects; they supply the Place of Bones in several Cases to Advantage; thus the Parts in the Pelvis are more safely supported below by Ligaments, than they could have been by Bone. The Ligaments placed in the Foramina Oveles of the *Ossa innominata*, and between the Bones of the Fore-arm and Leg, afford Frictions to

\* Wherefore Ligaments must be subject to the Diseases common to other Parts where there is a Circulation of Fluids.

Authors generally say, that Ligaments are insensible, and consequently it may be inferred, that they have no Nerves distributed on them; but the violent racking Pain, felt on the least Motion of a Joint labouring under a Rheumatism, the Seat of which Disease seems often to be in the Ligaments, and the insufferable Torture occasioned by a Collection of acrid Matter in a Joint, or by Tophi in the Gout, would persuade us that they are supplied with Nerves.

\* FABRICIUS AB AQUAPENDENTE's Observation will appear just, that *ceteris paribus*, in whatever Articulation, the Ligaments are few, long, and weak, the Motion will be more free and quick, but Luxations will frequently happen; and, on the contrary, where the Ligaments are numerous, short, and strong, the Motion will be more confined, but such a Joint will be less exposed to Luxations.

Muscles. Immoveable Bones are more firmly connected by them; of which the Conjunction of the Os Sacrum and Offa innominata is an Example. They afford a Socket for moveable Bones to play in, as we likewise see in the Scapula with the Humerus.

The EXTERNAL MEMBRANES of the BONES.

The Periosteum, in general, is a thin and strong Membrane or membranous Expansion, not equally thick through its whole Extent, more or less transparent, of a very close Texture, endued with extreme Sense, composed of several particular Lamellæ of Fibres, differently disposed, and mixed with a great Number of small Vessels and nervous Filaments.

The Bones in their natural State, are, for the most part, covered exteriorly by this Membrane, generally named Periosteum, which is extended even over the Cartilages and Ligaments, as well as over the Bones; but where it covers the Cartilages, it is termed Perichondrium, and where it covers the Ligaments, Peridesmium. The Portion which covers the Cartilages, and incloses the Ligaments, is provided with not many sanguiferous Vessels and nervous Filaments, therefore is not so sensible as that which envelopes immediately the Bones.

This Membrane does not immediately surround those Portions of Bones which are covered by Cartilages, nor those in which Ligaments and Tendons are inserted. Neither does it cover those Portions of Cartilages which are exposed to Friction, as in the moveable Articulations, Canals, &c. Lastly, It does not cover those Portions of the Teeth which lie out of the Sockets and Gums.

The interior Lamina of the fibrous Texture of the Periosteum, or that which immediately adheres

heres to the Surface of the Bones, is fixed thereto by an infinite Number of small fibrous Extremities brought from all the Laminæ, which enter the Pores of the Bones. These Extremities are accompanied by capillary Vessels and nervous Filaments, which, having run for some space between the different Laminæ of the Periosteum, perforate the innermost at the Orifices of the Pores of the Bones.

The Periosteum is of different Thicknesses; but this Difference does not appear near so much on the external Surface as on the internal, which is marked in many Places with Impressions, owing to the Sulci, Depressions, Lines, and Inequalities of the Surface of the Bones.

When we attempt to tear the Periosteum off the Bones, a Multitude of Filaments appear between this Membrane and the Bone, as coming from the internal Part of the Bone. After a successful Injection of the Arteries with a red Liquor, numerous Vessels are not only seen on the Periosteum, but most of the Fibres, going from the Membrane to the Bone, shew themselves to be Vessels entering the injected Liquor in them; and, when they are broken by tearing off the Periosteum, the Surface of the Bone is almost covered with red Points.

The Veins corresponding to these Arteries, are sometimes to be seen in Subjects that die, with their Vessels full of Blood, through such numerous Ramifications as cannot be demonstrated: As of the Arteries; the Veins are incapable of allowing an injected Liquor to pass from their Trunks into their minute Branches.

The great Sensibility of the Periosteum in the deep-seated Species of Paronychia in Exostoses, Nodi, Tophi, and Gummata, from a Lues Venerea, is a sufficient Proof that it is well provided with Nerves; though they are too small to be

traced by the Scalper; therefore we cannot well determine whether they are sent along with the Arteries in the common Way, or derived from the tendinous Fibres of the Muscles, expanded on the Peristoeum.

Some Authors endeavour to prove the internal Fibres of the Peristoeum to be derived from the Dura Mater, as they say, since the Pericranium is a Production or Continuation of the Dura Mater, which passes between the Sutures; and there are Muscles on the Head, as well as in other Parts, which might furnish a Periosteum; 'tis needless to assign another Origin to this Membrane. Even Havers adds further, to sustain this Hypothesis, that he can demonstrate the Periosteum to be continued from one Bone to another, by percuting and raising it from the Ligaments which cover the Articulation. Also Dr. NESBITT says the same in his Osteogeny, but it is not demonstrable from the Bones of an Infant. All these Arguments are to support that Doctrine, which prevailed formerly, that all Membranes proceeded from the Dura Mater. Others imagined, that the Periosteum limits the Growing of the Bones.

The general Use of the Periosteum is to support that admirable Texture of an Infinity of capillary Vessels, by which the Bones and all the Parts belonging to them are nourished. It likewise sustains a great Number of nervous Filaments, by which Sensation is communicated, not only to this, and to the internal Membrane of the Bones, but even in some degree to some Portions of the osseous Substance. From the vascular Texture of Bones, they are subject to Obstruction, Ecchymoses, Ulcers, Gangrenes, and a Variety of Caries.

The Solidity of Bones increases by Age. This is the Reason why the Bones of old Subjects are more friable than those of young ones.

The

## The MUCILAGINOUS GLANDS.

In all the moveable Articulations, especially of those Persons who end their Lives by sudden or violent Deaths, we find a viscid Liquor, in some measure resembling a liquid Mucilage, or the White of an Egg well beat, which is commonly called Synovia, a Name given at first to the Disease which affected this Part.

This Liquor is contained in the Articulations and ligamentary Capsulæ, which hinder it from running out. It is furnished chiefly by small Bundles of Glands more or less flat, contained in the same Capsulæ, and known by the Name of Mucilaginous Glands; these being the Organs through which this Mucilage is conveyed from the Blood. It may likewise partly transude through the Pores of the internal Surface of the capsular Ligaments; and partly be made up of an unctuous Matter pressed from the pingueous Substances lying near the Glands, by the Motion and Friction of the articulated Bones.

These Glands are more or less of a red Colour, and of a very singular Structure, resembling small floating Fringes of different Thicknesses, made up of folliculous or vesicular Grains, and furnished with a great Number of Vessels running in very different Directions. In some Places they appear like distinct Grains immoveably fixed. They are proportioned to the Bones and Joints, and lodged so as to be secured from violent Frictions, chiefly near the Edges of the Capsulæ, or in particular Cavities contrived on purpose to receive them.

The Liquor continually furnished by these Glands, mixed with that which transudes through the Pores of the Capsulæ, and perhaps with that which comes from the fat Molecules, is diffused between the articulated Bones, and its Use is to facilitate their Motions, to prevent them from

bruising each other, and to keep their Cartilages from drying or wearing out.

In the particular Description of each Articulation, we shall explain the Differences of mucilaginous Glands, with respect to their Conformation, Size, Number, and Situation.

The Liquor, which principally serves to moisten the Ligaments and Cartilages of the Articulations, is supplied by these mucilaginous Glands, which are commonly situated in the Joint, after such a Manner as to be gently pressed, but not destroyed by its Motion. By this means, when there is the greatest Necessity for this Liquor, that is, when the most frequent Motions are performed, the greatest Quantity of it must be separated. These Glands are soft and pappy, but not friable: They are mostly of the conglomerate Kind, or a great Number of small Glandules are wrapt up in one common Membrane. Their excretory Ducts are long, and hang loose, like so many Fringes, within the Articulation; which, by its Motion and Pressure, prevents Obstructions in the Body of the Gland, or its Excretories, and promotes the Return of this Liquor, when fit to be taken up by the absorbent Vessels, which must be in the Joints, as well as in the other Cavities of the Body; and at the same time, the Pressure on the excretory Ducts hinders a superfluous Secretion, while the firm-briated Disposition of these Excretories does not allow any of the secreted Liquor to be retrograded by these Canals towards the Glands, as COWPER \* has justly remarked.

Besides these conglomerate Glands, we meet sometimes with small simple Folliculi, observed by MORGAGNI †, that are full of Liquor.

\* Anatom. Explicat. Tab. 79. litt. E. E.

† Adversat. 2. Animad. 23.



Upon pressing any of these Glands with the Finger, one can squeeze out of their Excretories a mucilaginous Liquor, which somewhat resembles the White of an Egg or Serum, but is manifestly of a saltish Taste. It does not coagulate by Heat, as the Serum does; but turns first thinner, and when evaporated, leaves only a thin salt Film. Different Salts have much the same Effect on it, as on the other Juices of our Body; for Acids coagulate it, and Alkalies attenuate it. The Quantity of this Mucilage, constantly supplied, must be very considerable, since we see what a plentiful Discharge of Synovia follows a Wound or Ulcer of any Joint, of which the mucilaginous Liquor is considerably troublesome.

The Vessels which supply Liquors for making the Secretion of this Mucilage, and the Veins which return the Blood remaining after the Secretion, are to be seen without any Preparation, but after a tolerable Injection of the Arteries, the Glands are covered with them.

In a sound State we are not conscious of any Sensibility in those Glands; but in some Cases which I have seen, when they inflame and suppurate, the most racking Pain is felt in them: A Melancholly, though a sure Proof that they have Nerves.

These mucilaginous Glands are commonly lodged in a cellular Substance; which is also to be observed in other Parts of the Capsula, formed by the Ligaments of the Articulation, and contains a pinguous Matter, that must necessarily be attenuated, and forced through the including Membranes into the Cavity of the Joint, by the Pressure which it suffers from the moving Bones.

If then the Oil is conveyed from this cellular Substance, and if the attenuated Marrow passes from the Cancelli of the Bones by the large Pores  
near

near their Extremities, or in their Cavities, and transudes through the Cartilages into the Articulations; which it may, when assisted by the constant Heat and Action of the Body, more easily do, than when it escapes through the compact Substance of the Bones in a Skeleton: If, I say, this Oil is sent to a Joint, and incorporated with the Mucilage, and with the fine Lymph that is constantly ouzing out at the Extremities of the small Arteries, distributed to the Ligaments, one of the fittest Liniments imaginable must be produced; for the Mucus, diluted by the Lymph, contributes greatly to its Lubricity, and the Oil preserves it from hardening. How well such a Mixture serves the Purpose it is designed for, BOYLE \* tells us, he experienced in working the Air Pump; for the Sucker could be moved with much less Force after being moistened with Water and Oil, than when he used either one or other of these Liquors. And I believe every one at first View will allow the diluted Mucilage to be much preferable to simple Water. The Synovia, as this Liquor is composed of Oil and Mucilage, will therefore, while in a sound State, effectually preserve all the Parts concerned in the Articulations soft and flexible, and will make them slide easily on each other, by which their mutual Detrition and Over-heating may be prevented; in the Manner daily practised in Coach and Cart-wheels, by lubricating them with Grease and Tar.

After the Liquor of the Articulations becomes too thin and unserviceable, by being constantly spounded and rubbed between the moving Bones, it is reassumed into the Mass of Blood by the absorbent Vessels.

---

\* Physico-mechanic. Experim.

When the Synovia is not rubbed betwixt the Bones, it inspissates; and sometimes when the Head of a Bone has been long out of its Cavity, this Liquor fills up the Place of the Bone, and hinders its Reduction; or if a Joint continues long unmoved, the Synovia cements the Bones, and occasions a true Anchylosis. AMBROSE PARE \* says, he has frequently seen such Cases, and HILDANUS † gives a particular Example of it. If the Synovia becomes too acrid, it erodes the Cartilages and Bones, as frequently happens to those who labour under the Lues Venerea, Scurvy, Scrophulæ, or Spina Ventosa. If this Liquor is separated into too small a Quantity, the Joint, as GALEN ‡ remarks, becomes stiff; and when with Difficulty it is moved, a crackling Noise is heard, as People advanced in Years frequently experience. This Sort of Disease AQUAPENDENTE § very accurately describes, and rationally accounts for. If the Mucilage and Lymph are deposited in too great a Quantity, and the absorbent Vessels do not perform their Office sufficiently, they may occasion a Dropsy of the Joints, which HILDANUS || has at large treated of. From this same Cause also the Ligaments are often so much relaxed, as to make the Conjunction of the Bones very weak: Thence arise the Luxations from an internal Cause, which are easily reduced, but difficulty cured. Frequently when such a superfluous Quantity of this Liquor is pent up, it becomes very acrid, and occasions a great Train of bad Symptoms; such as Swelling and Pain of the Joints, long sinuous Ulcers and Fistulæ, rotten Bones, Immobility of the Joints, Macor, and Atro-

---

\* Surgery, Book XIII. Chap. 18. † Observat. Cent. III. Obs. 77.

‡ De Usu Part. Lib. XII. Cap. 2. § De Articul. Part. Utilitat. Pars III. || De Ichore & Meliceria acri Celsi.

phia of the whole Body; hectic Fevers, &c. HIPPOCRATES \* describes accurately most of these Symptoms from the diseased Mucus of the Joints; and HILDANUS † gives the Histories of many People labouring under them.

## OBSERVATIONS.

Notwithstanding what Dr. HALLAR endeavours to prove in his Dissertations, concerning the Sensibility and Irritability of the Parts of the Animal, the ingenious Dr. WHYTT, Professor of Medicine in the University of Edinburgh, has, I think, sufficiently proved in his Physiological Essays, that the learned Professor HALLAR has not well considered what he advances on this Subject.

When the cellular Substance, connecting the Periosteum to the surrounding Parts, is destroyed, these Parts are fixed to that Membrane, and loose the sliding Motion they had upon it; as we see daily in Issues, or any other tedious Suppurations near a Bone. When the Vessels which go from the Periosteum to the Bones are lacerated or eroded, a Collection of their Liquids is made between the Membrane and Bone, which produces a sordid Ulcer or rotten Bone. This often is the Case after Fractures of the Bones, and Inflammations of the Periosteum, or after the Small Pox, Meazles, spotted Fevers, and Erysipelas. Do not the Disorders of the Periosteum, coming along with, or soon after the cutaneous Diseases, incitate a Similarity of Structure in the Periosteum and Skin?

---

\* De locis in homine & de articul.

† De & Meliceira Ichoreacri Celsi.



## LECTURE III.

### Division of the BONES.

**I**T is proper we should consider in general the external Conformation of the Bones, their Connection and Uses ; I mean all that may be observed about them, while they remain intire, such as their Size and Figure of their external Parts.

Some Bones are large, as the Humerus Femur, those of the Leg, *Ossa Innominata*, some middle sized, as many Bones of the Head, the *Vertebræ*, Ribs, Metacarpus, and Metatarsus ; others, in fine, are small, as those of the Carpus, Fingers, Toes, and Teeth.

Some Bones are long, as the Humerus, Ribs, &c. some are broad, as the Parietal Bones, the Scapula, and *Ossa innominata* ; and there are others in which the three Dimensions of Length, Breadth, and Thickness do not differ much from each other, as the *Vertebræ*, Bones of the Carpus and Patella ; some others are symmetrical, a certain reciprocal Regularity being observed between their different Sides ; as the Frontal, Occipital, Sphenoïdal, Cribrosum, and Vomer Bones ; the inferior Maxilla, *Os Hyoides*, *Vertebræ*, Sternum, *Os Sacrum*, and Coccyx : These Bones are single, being placed in that Space which distinguishes the right Side of the Body from the left.

The

The rest of the Bones are double, or in Pairs, whereof one is situated on each Side of the Body. These, taken singly, have not that Symmetry already mentioned, but when annexed to the corresponding Bones on the other Side, they form a regular Figure, as we see in the Parietal Humerus and Femur Bones.

In regard to Extent and Figure, the long Bones are divided into a middle Part and Extremities ; the broad Bones into Side, Angles, Bases, and Edges : These Edges are sometimes termed *Costæ*, sometimes *Cristæ*, and they are sometimes subdivided in two lateral Parts, and called *Labia*. With regard to Situation, Bones are divided into the superior, middle, inferior, anterior, posterior, and lateral Parts, and these again into external and internal, as Occasion requires.

But in order to determine these several Parts exactly, the natural Situation thereof ought to be well observed ; in doing which, I shall always consider the Subject in an erect Posture ; and indeed it would be proper that this Rule should be extended to all the other Parts of the Body, that the Language of Anatomy might be perfectly uniform ; and that one Person, for Instance, might no longer call that the superior Part, which another calls the anterior, such Confusion may be of very bad Consequence in Reports delivered to Judges. We must likewise observe, that the Words internal and external, besides their ordinary and natural Signification, are taken in several other Senses by Anatomists.

In such Cases I shall call that Part internal which lies nearest a Plane, which being supposed to pass from the Crown of the Head down between the two Heels, divides the Body into the right and left Sides ; and the Part that is farthest from such a Plane, I shall name external ; thus the Edge of  
the

the Orbit, near the Nose, is internal, that near the Temples, external.

I shall observe this Rule likewise in the Parts which compose the Extremities : Thus I shall call that Side of the Tibia external, which is next the Fibula of the same Leg, and that internal which is next the other Leg.

The Bones of several Parts of the Body differ from one another in their Sizes, Cavities, Qualities, Figures, and Uses ; as will appear when we come to a particular Consideration of them ; but, I think, before we enter on that Subject, some Observations on them will not be amiss :

1. The Bone itself. 2. Its Cavities. 3. Its Conjunctions or Articulations with the other Bones. 4. Its Uses in regard to the Bone itself.

We are to observe,

1. The Diaphysis, or the principal Portion of Bones, which is the Middle, and in young Subjects, the first Part that indurates, and is, as it were, a Basis or Foundation of the rest.

2. An Apophysis is an Elevation or Excrescence from the Body of the Bone, of which it is a true continuous Part, as a Branch of a Tree. The Apophyses assume different Names according to their Figures. Caput, or Head, is a round Eminence at the Extremity of the Bone, and the Part immediately under it is called Cervix or Neck. Condylus, is an Eminence not exactly round, but a little flat : such are posterior Apophyses of the inferior Maxilla, &c.

A Protuberosity, or Tuberosity, is an Eminence of a considerable Extent ; but when the Surface is unequal and rough, such as that of the Calcaneum or Heel Bones, &c. Some other Precesses or Apophyses, take their Names from somewhat the Likeness they bear. Styloid, because it is sharp ; Mastoid, or Mammellaris, like the Nipples of

a Woman's Breast; Coracoïd, resembling a Crow's Bill; Clinoïd, like a Bed's Foot. Such are the Apophyses of the Sella Tarcia; Acronium or Anchoroïdes, like an Anchor; Crista or Crest; Coronoïd, the End a little pointed; Pterygoïd, like a Bat's Wing; when they are like a Tooth, Odontoïd or Dentiformis; Spinosa like Spina, as the Vertebræ of the Back; Recta, when the Processes or Apophyses are strait, oblique, transversal, &c. None of these Eminencies derive their Names from their Use, except those of the superior Part of the Femur, which we call Trochanters, which signifies to turn.

The Inequalities, observable on the Surface of the Bones, serve principally for the better Security of the Insertion of the Muscles.

The principal Uses of the Apophyses of the Bone are, First, for the better making Articulations, whether they are intended to have Motion, or to be fixed: Secondly, To afford a proper and firm Place of Origination and Insertion for the Muscles; and, Thirdly, To defend the other Parts.

An Epiphysis is an osseous Substance, or, as it were, a lesser Bone, affixed to a larger or principal Bone, by the Intervention of a Cartilage. In young Subjects, these Epiphyses are not continuous to the principal Bone, but are only connected by the intermediate Cartilage; and hence they are called Appendages to the Bones.

The principal Things to be observed of these Epiphyses are: 1st, That they are all cartilaginous in Infants; and though they afterwards gradually grow harder, yet they never arrive at the true Density of a Bone, but are always lax and spongy. 2dly, That most of them degenerate into Apophyses in Adults. 3dly, That they do not grow along the plain Surface of the Bone, but inequally by a natural Ingress with the Body of it.

4thly,



## Lect. III. Division of the Bones. 65

4thly, That their Nature and Conjunctions are much more obvious in younger than in older Subjects. 5thly, That the Body of the principal Bone itself is spongy and tender about the Place of the Conjunction.

1. Wherever we mention any Parts being cartilaginous, or their being still separable from the other Parts of the Bone to which they belong, we would be understood to hint, that about seven or eight Years of Age, such Parts are ossified and united to their proper Bones, unless when it is said that they are afterwards formed into Epiphyses.

2. Such as become Epiphyses are generally ossified at seven or eight Years of Age, but being for the most Part moistened by Synovia, their external Surface is still somewhat cartilaginous, and they are not yet united to their Bones.

3. At eighteen or twenty Years of Age, the Epiphyses are entirely ossified, and have blended their Fibres so with the Body of the Bone, as to make them inseparable without Violence.

The Knowledge of this Part of the Osteogeny, is very necessary to prevent dangerous Mistakes in the Cure of several Diseases: As for Example, without this Knowledge, the Separation of an Epiphysis might be mistaken for a Fracture or Luxation. The Interstice of two Parts of a Bone not yet joined might be judged to be a Fissure. A Diastasis, or other violent Separation of such disjointed Pieces of a Bone, might be thought a great Fracture. The Protrusion of one Piece over any other, might be mistaken for an Excrecence or Exostosis. Such Errors about the Nature of a Disease would give one very different Indications of Cure, from what one would have, if we really understood the Patient's Case. And very often the Knowledge of the different Inequalities on the Surfaces of

## 66 Division of the Bones. Lect. III.

Bones must direct us in the Execution of what is proper to be done to cure several Diseases of Bones \*.

The Use of the Epiphyses is very different in Infants and Adults.

In Adults, they seem to serve to the Bones, which contain large Quantities of Marrow, 1st, By way of Covering, that this soft Matter may not run out. 2dly, They are of Service to the Articulations, rendering the Motions more easy, as well as more determinate. 3dly, They make the whole Bone lighter than it would be, if their Place was supplied by absolute osseous Matter, as they are much more spongy. 4thly, They greatly increase the Power of the Muscles about the Tendons, by means of their Prominencies. 5thly, They add greatly to the Size of the Places destined for receiving the Insertions of the Muscles. 6thly, They give a firmer Cohesion to the Ligaments, which serve in the Articulations, and allow an Ingress to the sanguiferous Vessels.

The Uses of the Epiphyses in Infants are, 1st, That by means of their yielding Softness, they may give way to the Compression in the Uterus, and suffer the whole Bulk to be more folded together, than otherwise it could, so that it may lie in a smaller Compass. 2dly, That they may give way to the Elongation and Growth of the Bones; that as the Body grows, they may be proportionably extended as necessary. 3dly, Likewise, that they may prevent the frequent Fractures which

---

\* We observe, that some Epiphyses have Apophyses belonging to them, as the inferior Extremity of the Tibia, and some Apophyses have Epiphyses annexed to them; as Trochanter Major, and the Head of the Femur is a true Epiphysis of that which is called Cervix, except the Bodies of the Vertebrae, or Ossa innominata; which Ossification does not begin at the middle Portion, which is the principal Part in an Adult.

## Lect. III. Division of the Bones. 67

would otherwise unavoidably happen to Children from their Falls.

The Cavities met with on the external Surface of Bones are of two kinds, some of which are destined for the Articulations, whilst others are of no Use for that Purpose; the first are either large or small; the large called *Cotyloïd* or *Acétabulum*, such as the Cavities of the *Ossa innomminata*. The small called *Glenoïd*, such as Cavities of the *Scapula* or *Omoplata*; they are deeper in fresh Bones, than in such as have been dried, because of the cartilaginous Eminencies intended by Nature for the Assistance of the Articulation, being taken away in these. These Cavities contain a mucilaginous Liquor, and the Ligaments of the Articulations, probably also from the Marrow itself. This is destined for the lubricating the Bones, and facilitating their Motions on one another.

The external Cavities have received various Names, somewhat liker their Figures. 1st, *Fossa* is a Cavity whose Entrance is generally larger than its Bottom; such are those of the coronal Bone. A *Sinus*, on the contrary, is larger at its Bottom than at its Entrance, as is observable in the frontal and maxillary Sinuses, &c.

A *Sinuosity* is a Cavity, more extensive in its Length than in Breadth; such is observable in the superior Part of the *Humerus*, &c.

A *Scissure* differs from a *Sinuosity* in this; that it is narrower, and only lodges Vessels, such as those of the *Ribs*, &c. whereas a *Sinuosity* receives only Tendons, and is lined with a Cartilage.

A *Sulcus* is a Cavity in form of a *Crescent*, and is generally found in those Parts through which Apertures perforate; such are those of the *Vertebræ*.

*Foramina* or *Holes*, are Cavities whose Entrances are very near their other Extremities; such are those in the *Basis* of the *Cranium*.

## 68      Division of the Bones.      Lect. III.

A Canal is a Cavity, whose Extremity is at some Distance from its Entrance ; such are the Maxillary Canals, &c.

A Fissure is a longitudinal and narrow Cavity, having its Entrance near its other Extremity ; such are the Fissures of the sphenoid Bone, &c.

These different Cavities are for the most part formed in the same Bone, tho' some of them are produced by the Meeting or Concurrence of several Bones, which has laid a Foundation for distinguishing them into proper and common.

The proper are those found in the same Bone ; such are the Fossæ, observable in the internal Surface of the Cranium, which are for that reason called Coronal. The others called common, are the Fossæ Orbitariæ, the Foramina Lacerata, &c.

Besides all these different Cavities, we also observe on the Surfaces of the Bones, several Sulcuses or Furrows, which terminate in so many Holes of indefinite Smallness ; we there also observe the Orifices of several Canals, which penetrate into the internal Substance of the Bones.

The Regions of the Bones are distinguished with respect to their Extent, their Situation, and other Circumstances.

The long Bones are distinguished into the superior, the middle, and inferior Parts ; and the broad Bones into their external and internal Surfaces, &c. observing always to have Regard to the natural Situation of the Body, that is, to suppose the Skeleton in an upright Position.



## LECTURE IV.

SYNOSTEOGRAPHY: Or, the Connection of the BONES by means of their natural LIGAMENTS.

**T**HE Articulations are distinguished into two Kinds; the one permits a Motion in their articulated Pieces, and is called Diarthrosis; the other permits of no Motion, and is named Synarthrosis.

The Diarthrosis is of two Kinds; the one permits a sensible and manifest Motion, and the other only such as is obscure and imperceptible. The manifest Diarthrosis is performed with a free Motion, in various Directions, as is observable in the articulating of the Humerus with the Omoplate; in that of the Femur with the Os innominatum, &c.

Or it is only performed with a Motion confined to two Directions, as in the articulating of the Cubitus with the Humerus, in that of the Phalanges of the Fingers with each other, &c.

This Articulation is formed by the Reception of an Eminence into a Cavity, as is observable in the joining of the Humerus with the Scapula; of the Femur with the Os innominatum, &c. This Species of Articulation is more or less deep, which

has given Occasion to the Antients, to distinguish it into two Species ; the deepest they called Enarthrosis, and the most superficial Arthrodia.

Ginglymus is an Articulation, whose Motions are confined to certain Directions. This kind of Articulation with Motion, in which two Bones are connected by one or more Heads received into as many Cavities ; and the Motion arising from this confined to two Directions only.

A Ginglymus in general is divided into two Sorts ; the one perfect, and the other imperfect ; the perfect is that formed by several Heads and several Cavities, and in which the two Bones receive one another mutually, as is observable in the joining of the Tibia with the Astragalus ; and in the Phalanges of the Fingers with each other, &c.

A Ginglymus is said to be imperfect, when the joining of the Bones is only formed by two Eminencies, received into two Cavities, as is observable in the Articulation of the occipital with the first cervical Vertebra ; and the Vertebrae with each other by their oblique Apophyses, in that of the Femur with the Tibia, &c. Or when a connecting of two Bones is only formed by the Reception of one Eminence into one Cavity, as is observable in the Articulation of the first with the second Vertebrae by means of its odontoïd Apophysis, or in that of the Ulna with the Radius, as well in the superior as in the inferior Part of these Bones.

The obscure Diarthrosis, or that which permits but of very imperceptible Motion, is principally observed in the Bones of the Carpus, and most of those in the Tarsus.

The Synarthrosis is that Species of Articulation by which the Bones are kept together in such a manner as to remain in a firm Situation : It is performed two different Ways ; the first is by  
Inden-

Indentation, and the second in the same Manner as a Nail or Pin fixed in Wood. The first may be divided into two Kinds, one deep and the other shallow: The deep Indentation is observed in broad Bones, and is by the Fathers of Anatomy called Suture, which is evidently seen in the joining of the Bones in the Cranium. The shallow Indentation is that observed in the Bones, which are joined by more extensive Surfaces, and whose external Connecting does not appear denticulated. This is what the Antients have called \* Harmony, and for an Example of this Kind they have mentioned the Bones of the Face.

The second Species of Synarthrosis is called Gomphosis: It may be compared to a Nail, or a Peg received into a Hole, such is the Reception of the Teeth into the Cavities of the Maxilla, Alveoli, or Sockets.

All the Places which compose the Skeleton, are naturally united with each other; and this Union is by the Antients called Symphysis, which is distinguished into two Kinds, one with and the other without Means.

A Symphysis is said to be without Means, when the assembled Bones are maintained in that State by themselves, that is to say, merely by their own Conformation: Such are the Parietals, which mutually support each other, by the peculiar Structure of their Teeth; that is to say, of the Eminences and Cavities, which constitute this Suture; likewise of the other Bones of the Cranium, &c.

---

\* There is no such Thing as Harmonia or Articulation, in which the Bones are joined by a bare Touch or strait Line, and those of the Superior Maxilla, which were pointed out for an Example, have all of them, like those of the Cranium, Cavities, which cross and mutually receive one another like Saw Teeth,

Some refer to the Symphyfis without Means, the Union of the two Pieces, which compofe the inferior maxillary Bone in young Children ; but it ought to be obferved, that this Union is only a Confequence of the Offification of thefe two Pieces.

The fecond Species of Symphyfis is by Means, which unites, faftens, or maintains the Collection of the Bones, by the Affiftance of Cartilages, Ligaments, and Mufcles ; and this is what the Ancients have called Synchronofis, Synneurofis, and Syffarcofis.

The Synneurofis, which is the faftening of Bones by Ligaments, is principally met with in all the moveable Articulations. It alfo fortifies the Synchronofis, as is obfervable in the articulating of the Vertebræ by their Bodies.

The Synchronofis, which is the faftening of the Bones, by means of Cartilages, is principally obfervable in the articulating of the Vertebræ by their Bodies, in that of the Offa Pubis, with each other, &c.

The Syffarcofis is when the Bones are united by means of Mufcles, fuch as is the Junction of the Scapula with the Ribs.

The Syndefmus happens when the Bones are joined by the Help of a Ligament, fuch as thofe of the Carpus, Tarfus, Hyoïdes, &c.

The Syntefmus is when the Junction is made by a Tendon, fuch as is the Head of the Femur in the Cavity of the Ifchium.

The Synymenfis is when the Union is affected by a Membrane, as 'tis with moft Parts of the Articulations.

The Manner of the Junction of the Bones, in order to facilitate their Motion, is called Articulation.





## LECTURE V.

### OSTEOGRAPHY: Or, the Description of the BONES in particular.



THE Cranium is formed by an Assemblage of eight Bones, each composed of two Laminæ or Tables, one of which is external and the other internal. This latter is called Vitrea, because it is thinner, and friable as Glafs. Between these two Tables, there is a spongy Substance called Diploë\* or Meditullium, which is not of the same Thickness through the whole Cranium; for in some Parts it runs but thin, and in others it is not to be met with at all.

The Bones of the Cranium are divided into two Classes, proper and common: The proper are, according to Authors, six; but it appears to me there are but three, viz. Os Occipitis, and Ossa Bregmatis, and all the rest are common with those of the Face.

---

\* The Diploë is much of the same Texture as the Cancelli of the other Bones, and contains likewise a medullary Juice, with numerous Ramifications of sanguinous Vessels spread on them; but sometimes in old Crania the Diploë is so obliterated, that scarce any Vestiges are left. Often a Collection of Matter is formed in the Diploë, either from internal or external Causes; wherefore Surgeons are not to trust the Bleeding of the Diploë in performing the Operation of the Trepan, but ought to observe also the Sinuses and Sulci made by the Pulsation of the Arteries of the Dura Mater in the Fœtus State.

As the Os Sphenoïdes is the Basis of all the Bones of the Cranium, and most of those of the Face, I think it proper to deviate from the common Rule of Anatomists, and begin with the Description of this Bone, and proceed with those which appear the most contiguous in their Situation.

OS SPHENOÏDES, or rather BASILARE (because its Situation is in the Middle of the Cranium, and it is the Basis of all the Bones of the Cranium, and almost of those of the Face) is of a very irregular Figure, and somewhat resembling that of a Bat, with its Wings extended. This Bone is divided into a Body, and two flat Apophyses called Sphenoïd.

We are likewise to distinguish it, in two Surfaces, the one external, and the other internal. The external has six Apophyses, two Foramina or Holes, two Sinuses, and six Scissures. Of these, the first two are Pterygoïd, so named from their Likeness to a Bat's Wings; they have each a pretty long Sinus, and at their inferior Extremity they have each a small Hamus, somewhat like an Apophysis. The third and fourth make the internal and inferior Part of the Orbit; and the fifth is a little Process, like the Crista Galli, in its anterior Part, which is received in a Cavity at the further End of the Vomer. In its internal Side, it has four Clynoïd Apophyses, which form a Cavity in the Middle of this Bone, called Sella Equina, or Turcica.

Between the two Tables of this Bone under the Sella Turcica there is a Sinus, sometimes divided into two in the Middle, which opens by two Foramina into the Cavity of the Nostrils, and sometimes is totally wanting\*.

---

\* This Bone in young Subjects is divided into two or three; but in Adults it is only one Bone, called the Cullender by the Antients; because they believe the Phlegm passed through the Holes in this Bone into the Mouth.

OS FRONTIS, or CORONAL, (so called by the Ancients from placing their Laureat Crowns on the Forehead Bone\*) is situated in the anterior Part of the Cranium, and forms the superior Part of the Face, and of the Orbits. This Bone has two surfaces, one external and one internal. In the interior Part of its external Surface are five Apophyses, four of which are called by some Anatomists Angles of the Eyes, and by others Orbitaries; and distinguished them into internal and external. The fifth, named Nasal, serves as a Support to the Bones of the Nose. In this Place also are two Depressions which make Part of the Orbits, and of the superior Rim of the Orbits: There are two Foramina, termed superciliary, which are oftentimes no more than Scissures; at the inferior and middle Part of the Coronal, there is a Canal to lodge the Os Ethmoides, and at the connecting of these two Bones, (especially near the Orbits) we find a Foramen on each Side, and sometimes two, which are called the internal Orbitary Foramina. In the internal Surface of the Coronal, we are to consider two Depressions also named Coronal, a Spine, a Scissure, a Foramen called Blind or Spinal, and several superficial Depressions, which correspond to the Circumvolutions of the Cerebrum.

In the middle and inferior Part of this Bone, we find the two Cavities, called the frontal or superfiliary † Sinuses, which run through the whole Thickness of the Bone, and communicate with the Nose.

In some Subjects we have but one of these Sinuses, and in others they are both wanting; and rarely found in Children.

---

\* This Bone is always divided into two in Infants, and sometimes remains so in Adults.

† These Sinuses and the Spine in this Bone, to which the Dura Mater adheres, make it very dangerous, if not impracticable to apply the Trephine or Trepan, on the middle and inferior Part of this Bone.

**OS ETHMOIDES, or CRIBRIFORM, or CRIBROSUM,** so called because it is perforated like a Sieve. In this Bone we observe its Situation in the Base of the Coronal Bone, and its Extension through the Nostrils and Orbits; its four Apophyses, the Crista Galli, and the two *Ossa Spongiosa Superiora*, which are called also by some Anatomists *Turbinatae*, to which *MORGAGNI* has added two other smaller ones, the *Cribriforme*, *Carverose*, *Papyraceous* or *Plane Parts*, under the various little *Sinuses*. Some take these spongy Parts of the ethmoid Bone for peculiar Bones, but they are always continuous in Adults. In the external Parts, near the Orbit, these Cellules are confined by the *Os Unguis*, and a very smooth Lamina, of which the Antients made a particular Bone they called *Os Planum*. In the internal Surface of the ethmoid Bone, we observe a Lamina called *Cribriforme*. The Apertures found in this Bone retain the Name of *Olfactory*, from those Nerves which pass thro' them\*.

**OS TEMPORUM** (so called because the Hairs first become grey on these Bones) are generally divided into two Parts; one superior, called *Squamous* or *scaly*, and another inferior, called *Petrous* or *stony*. These two Parts are easily separated from each other in young Subjects, but they become so firmly united afterwards, that it is impossible to divide them in Adults; in these we are to regard the Situation and the Figure which are very irregular; the Connection and the Substance, which are as their Names express, their four Apophyses; and are, the *Incala* or *Zygomatic*; the *Mastoid*, the *Styloid*, and *Petrous*; the Place where the inferior Max-

---

\* *CHESEBURY* says, that he could never discover these nervous Filaments. I believe he was the only Author among the Moderns.

illa is articulated ; the *Mearus Auditorius*, or *Auditory Passage* ; and the *Sigmoid Fossæ* : Here the lateral *Sinufes* of the *Dura Mater* are placed. In the temporal Bone, and particularly in its petroſeous Part, are to be obſerved the Cavity of the Drum, and the *Officulæ Auditivæ*, or the little Bones that ſerve to the Organs of Hearing, which are commonly four in Number, viz. The firſt is named *Malleus*, or *Hammer* ; in this we are to obſerve the Head, the Neck, and the Handle, which is joined to the Membrane of the *Tympanum* or Drum ; its two *Apophyſes* are alſo to be obſerved ; theſe ſerve for the Inſertion of the external Muſcle of the *Malleus*.

The ſecond is the *Incus* or *Anvil*, in which we are to obſerve the Body of the Bone, and its *Fovea* or *Hollow*, ſerving for its Articulation with the *Malleus*, and its two *Crura* or *Legs* ; to the longer of which there is joined another Bone, called *Strapes* or *Stirrup* : In this Bone we are to obſerve the Head, which is joined to the longer Leg of the *Incus* ; its *Baſis*, which ſtands on the *Fenestra Ovalis* of the *Labyrinth* of the Ear, and its lateral Parts, which have their internal Surface furrowed. What is generally called the fourth Bone of the Ear is placed between the *Incus* and the *Strapes*, and is named *Os Orbiculare*, or *Lenticular Bone*, and is reckoned the ſmalleſt Bone of the whole Body. But this is not truly a diſtinct or ſeparate Bone, but is merely an *Epiphyſis* of the longer Leg of the *Incus*.

Of the *Foramina*, the firſt is the *Fenestra Ovalis*, on which the *Base* of the *Strapes* ſtands ; near this is the ſecond, which is called the *Fenestra Rotunda* : This leads to the *Cochlea*, the other to the *Vestibula* of the Ear. The third *Foramen*. by means of a Canal, is carried to the Mouth : This

is called the Eustachian Duct or \* Tube, from the Name of its Discoverer. The fourth Foramen opens into the Cellules of the Mastoid Process. All these are for the Use of Hearing. The remaining Part of the Ear will be treated on when we speak of the Organ of Hearing.

*OSSA PARIETALIA*, or *BREGMATIS SINCIPITIS*, or Bones serving as Walls to the Encephalon. In these we are to observe the Situation and Figure, which are nearly a Square, their Size and Connection with the other Bones of the Cranium, and their Thickness. Their external Surfaces are likewise to be examined ; their internal Surfaces, in which there are Furrows representing Shrubs, or Fig-leaves, are formed by Arteries of the Dura Mater, when yet the Bones are soft ; and besides these there are Fovæ or hollow Places : And finally, we are to observe the Place called the Bregma, and, in Infants, the Fontanella, or Fons Pulsalis. The external Surface of these Bones is convex, and pretty smooth ; along their middle and inferior Parts, we find some Eminencies and Cavities to facilitate their connecting with the squamous or scaly Part of the Temporals. We sometimes observe a Foramen in the superior and posterior Parts of these Bones.

*Os Occipitis*, thus named because it lies in the posterior Part of the Head. In this Bone, we are to observe its Situation and Figure, which is irregular, and its State in Infants, in whom it is usually composed of four Pieces ; after this we are to regard its Connections and its Substance, which is very thick in some Places.

---

\* They say, it is through this that some People have Ways of discharging at the Ears the Smoak of Tobacco taken at the Mouth ; but that cannot be, unless the Tympanum Membranam be lacerated ; but People subject to Deafness, may hear best when their Mouths are open.

There are three Apophyses, two of which are condyloid, and serve for the Articulation of it with the Atlas, or the first Vertebra of the Neck, and to support the whole Cranium. The third is extended to the Sella Equina. In the internal Surface of this Bone in Adults, there is a Figure of a Cross, and to this adheres the Sinuses and Processes of the Dura Mater ; and within this there are also four Cavities, in which the posterior Lobes of the Cerebrum or Brain, and the Cerebellum lie.

In the external Superficies, there are several superficial Eminencies and Depressions to be observed after the great Foramen : These serve for the Insertion of several of the Muscles of the Head. The thinner Parts of this Bone are also defended by Muscles, that cover them ; which Provision is very necessary, because we can least defend this Part ; and Blows here are of worse Consequence than in any other Part of the Cranium ; because Wounds in the Cerebellum, which is underneath, are mortal.

There are in most Crania a Foramen behind each Apophysis of the occipital Bone, through which pass Sinuses, from the lateral Sinuses to the cervical Veins : By means of these Communications of the Sinuses, the Blood passes from those that happen to be surcharged by any Posture of the Head, into those, that from the same Posture, would have been almost empty. Such Craniums as want these Foramina, have two Sinuses for the same Purpose.

#### THE BONES OF THE FACE.

Os Maxilla Superior, is always described single, tho' it is manifestly divided into two, by a Suture, which is scarce ever obliterated. In each maxillary Bone we observe three Apophyses ; the first is  
called

called the Angle of the Maxilla, and forms a Part of the Arch of the Nose ; for which Reason it is commonly called Nasal. The second is by some called Malaris, or Jugal ; and the third, Spine, which being united with that of the opposite Maxillary, forms with it a kind of Crest for fixing the Cartilage, which makes a Part of the Septum Nasi, or Nasal Partition.

In the Maxilla, we also observe a Canal, named the Superior Maxillary, which runs along the inferior Part of the Orbit ; and the whole external Orifice is called by some, the external orbitary Foramen. We here find also, at the Side of the Spine a Foramen, which in its inferior Part terminates by a Sinus, and, uniting with a similar one, in the other Maxilla, forms a Hole in the anterior Part of the Palate, called the incisory Aperture. In the internal Surface of this, there are small Holes which have no particular Names. In the Maxilla, we are also to consider three Sinuses ; the first at the Entrance of the Nasal Fossa ; the second at the Entrance of the Orbitary Fossa ; and the third performs the greatest Part of the Nasal Duct. In the internal Surface of each Maxilla, which forms Part of the Nasal Fossa, we discover the Orifice of the maxillary Sinus, which is a very considerable Cavity made through the whole Thickness of these Bones ; we also remark along their inferior Part, several Apertures called Alveoli or Sockets, which are made in the Thickness of the Bones, and in Adults, their Number is generally eight in each Bone. The Parts of the Cavities that lie next to the Nose, are only membranous, which makes the Cavities like Drums ; perhaps to give a grave Sound to the Voice, when we let it through the Nose. Imposthumations sometimes happen in these Cavities. The Signs of this Disease are great Pain about the Part, Matter in the Nose on the Side diseased,



diseased, stinking Breath, and rotten Teeth. COWPER was the first who described this Case, and the Cure; which is performed by drawing out the last Tooth but one or two, or more, if rotten, and through their Alveoli or Sockets, making a Perforation into the Antrum; or if drawing a Tooth makes an Aperture, which sometimes happens, and perhaps gave the first Hint of this Cure, then the opening must be enlarged, if it is not sufficient to discharge the Pus or Matter. The Teeth shall be described after the Description of the Maxilla inferior.

OSSA PALATI, are commonly described as two small square Bones at the posterior Roof of the Mouth, though they are of much greater Extent, being continued up to the back Part of the Nostrils, to the Orbit of the Eyes. Each Palate Bone may therefore be divided into four Parts, viz. the Palate Square, the Pterygoid Process, Nasal Lamella, and Orbital Process: In these Bones we are also to consider two Sinuses and one Foramen. Of these Sinuses, one contributes to form a particular Duct, whose Orifice is observed in the posterior Part of the Palate; it is called the Gustatory Foramen, or the posterior Foramen of the Palate, in order to distinguish it from the incisory one, by some called the Anterior. The other Sinus helps to form the Spheno, by others called the Pterygo Foramen of the Palate. The Size of this is to be regarded, and the Construction of the Orifice or Aperture in living Subjects; also its Use, which is double; first, for the Assistance of the Voice; secondly, for the Secretion of a mucous Matter. We are also to observe the Nasal Canal.

These Bones are very complete in new-born Infants, the Nasal Lamella, being thicker and stronger than in Adults; but the orbital Pro-

cesses have not the Cells which appear in the Bones of Adults.

When we are acquainted with the Structure of these Bones, the Reason is evident, why the Eyes are so much affected by Ulcers of the Palate, as to be often attended with Blindness, which frequently happens in ill-managed Venereal Diseases, &c.

*OSSA TURBINATA*, or *SPONGIOSA INFERIORA*, are so named from their pyramidal Figure and spongy Texture, without any smooth, firm, or external Lamella, and from their Situation at the inferior Part of the Nostrils, their Use is to straiten the Nostrils, to afford a large Surface for extending the Organ of Smelling, to prevent the Sharpness of the Air from rushing this way into the Lungs, and little Insects getting into the Fauces; and they increase also the Expansion of the Pituitary Membrane, for various Purposes; likewise to assist in forming the inferior Part of the lachrymal Ducts; the Orifices of which into the Nose, are concealed by these Bones. These *Ossa Turbinata* are complete even in a new-born Infant.

*OSSA UNGUIS*, or *LACHRYMALIA*, are so called, because their Figure and Magnitude is something like a Nail; and by the Tears passing upon them into the Nose, they are named *Lachrymalia*. Each of these Bones are situate in the *Canthus Major*, or Corner of the Orbit of the Eyes. These unguiform Bones, compose the anterior internal Parts of the Orbits, lodge the lachrymal Sac and Duct, and cover the *Cellula Ethmoïda*; there is a Foramen into which the *Puncta Lachrymalia* lead; to carry off any superfluous Moisture, from the Eyes into the Nose. From which Situation, and tender Substance of these Bones, we see how easily an unskilful Surgeon may destroy a considerable  
Share

Share of the Organ of Smelling, in performing the Operation of the Fistula Lachrymalis; but these Bones, when hurt, will exfoliate without much Difficulty, and consequently the Wound will be soon cured, unless the Patient labours under a general Cacoethes, or there is a Predisposition in the Bones to a Caries. These Bones are fully formed in a new-born Child.

**OSSA MALARUM, JUGALIA ZYGOMATA, or CHEEK BONES.** These Bones form the anterior, inferior, and external Parts of the Orbits. They have each four Processes, one of which joins the Apophysis of the temporal Bone; the second reaches the Frontal, the third is connected with the superior Maxilla, and the fourth is the posterior superior one, which is the longest and thickest, called the Superior Orbitaly Process, and all form Arches, which Anatomists call Zygomata, or Ossa Jugalìa, which signify Yokes. These Bones concur greatly in forming the inferior Part of the Orbits, and the Canthus Minor; they also make the prominent superior Part of the Cheeks most remarkable in lean Persons. We find commonly on the external Surface of the Ossa Malarum, small Foramina, for the Transmission of nervous Filaments and sanguiferous Vessels sometimes into the Orbits. On the internal Surface, the Foramina for the Passage of the nutritious Vessels to them are very conspicuous. The great Fissure at the external Orbit, may be considered as an Aperture common to these Bones, Sphenoid, Maxillary, and Palate. The Substance of them is in Proportion to their Bulk, thick, hard, and solid, with some Cancelli.

**OSSA MALARUM** are intire, and fully ossified in all their Parts in Infants.

**VOMER**; thus called by the Fathers of Anatomy, as it somewhat resembles a Plough-share.

This Bone forms the inferior and posterior Parts of the Septum Narium ; its Figure is an irregular Rhomboid or Square ; posteriorly it appears in an oblique Direction. The superior Side is firmly united to the Basis of Os Sphenoides, and to the Nasal Lamella of the Ethmoides, and is received on the Processus Azygos of the Os Sphenoides. The inferior Side is firmly united to the Nasal Spines of the Maxillary and Palate Bones. The posterior Edge of the Vomer, is broader above ; but as it descends forward, becomes thinner, tho' it is still solid and firm. Its inferior Edge which rests on the Nasal Spine of the Palate Bones and Maxillary, has a little Furrow on each Side of a small Ridge, answering to the Spines of the Bones of different Sides, and the Interstice between them. This Edge and the superior one meet in the pointed anterior End of this Bone.

Its Situation is not always perpendicular, but often inclined, as well as the Nasal Lamella Ethmoidæa, to one Side.

The Vomer divides the Nostrils, enlarges the Olfactory Organ by affording room for expanding the Membrana Narium on its Sides, and sustains the Lamella of the Palate, and Maxillary Bones ; which otherwise might be in Hazard of being pressed into the Nostrils, whilst the Vomer is secured from moving to one Side or other by the double-connected Schindylesis, by which it adheres to the superior and inferior Bones.

OSSA NASI, or the proper Bones of the Nose, are two connected together ; each of these Bones is of an oblong square Figure, the superior Extremity being narrow and thick, the inferior oblique and thin ; the middle Part curved inwards near  
the

the superior End in some Subjects, in others almost strait.

The anterior or external Side is convex, though a little depressed or hollowed above its Middle. The posterior Side is gently concave; the superior Extremity is very thick, full of Points and Depressions; the inferior Extremity is thin, unequally indented, and cut obliquely in such a Manner, that the two Bones, connected form an acute Slope; the interior Rim, contiguous to the same Margin of the other Bone, is even, except towards the superior Part, where there are sometimes little Indentations, there is a small Foramen towards the concave Side, (which often is wanting in one of the Bones); when they are connected, these Edges represent a sort of Crista, or prominent Line, answering to the Septum Narium. About the middle of the external Side, sometimes higher, sometimes lower, there is a Foramen, which is often deficient in one of the Bones, and at other times several of them are not perforated.

The Substance of these Bones is almost compact, however, sometimes, there are some Cancelli towards the superior Extremities.

They are connected mutually above, to the Nasal Apophysis of the Os Frontis, laterally to the Nasal Apophyses of the Offa Maxillaria, and interiorly or posteriorly to the anterior Rim of the perpendicular Lamina of the Os Ethmoides, by Means of the prominent Line already described.

They form the anterior and superior Portion of the Nose, and Part of the Septum Narium.

In an Infant the Nasal Bones are proportionably complete.

MAXILLA INFERIOR, MANDIBULA, FACIES, or the LOWER JAW, is composed of two Pieces in

young Subjects, without including the Teeth. These two Pieces are, in Process of Time, united by a Symphysis, which it is impossible to separate.

They have Surfaces, one external, which is convex; and another internal, which is concave. We also distinguish it in a Body and two Extremities; the Body is, as it were, divided in its Middle by a prominent Line, which denotes the Place of the Union of the two Pieces, which compose the inferior Maxilla in Children; and this Line is called the Symphysis of the Mentum or Chin.

The Extremities have two Apophyses on each Side; the anterior sharp thin ones are named Coronoid; the posterior ones are called Condyles, and terminate in an oblong smooth Head, supported by its Cervix.

The Foramina of the Maxilla, are two on each Side; one at the Root of the Processes internally, where a large Branch of the third Branch of the fifth Pair of Nerves and an Artery enter, and a Vein returns. A small sharp Process frequently projects posteriorly from the anterior Edge of this Foramen, and from its inferior Side, either a small superficial Canal descends, or a Furrow is to be observed, where a small Branch of the Nerve is lodged, in its Way to the Mylo-hyoideus Muscle and sublingual Gland.

The other Foramen is external, at the Confines of the Chin, where these Vessels have their egress. The Canal betwixt these two Foramina, is formed in the Middle of the Substance of the Bone, and is pierced by a great Number of small Apertures, by which the Nerves and Blood-Vessels of the Cancelli and Teeth pass. The Extremity of this Canal is continued a little farther than the external Foramen at the Chin. We may easily conceive how the several Motions of the inferior Maxilla

illa are performed : For while the Teeth of both Jaws coincide, the Condyles securely play in the Cavities ; but when the inferior Teeth are advanced forward, beyond the Range of the superior, the Maxilla rests on the Tubercles, by which the necessary Advancement of this Bone is allowed ; and notwithstanding the Change of Place, a firm Axis of Motion is still afforded : Though at the same Time it must be granted, that in this straining Position we cannot open our Mouths, unless by a convulsive Action of the Muscles, and then not without some Danger of a Luxation of the Condyles, which often happens to old People, or Children in yawning. Whence the common Practice of Nurses in restraining the Jaws of Children from opening too wide in that convulsive Motion, is far from unreasonable. These Cartilages also serve to render the Articulations loose enough for performing the lateral Motions ; and therefore, by a quick Succession of the Motions forwards, to one Side, backwards, and then to the other Side, the Condyles may be moved in a Circle, which is of good Use in chewing.

Here a general Remark may be made, That wherever such moveable Cartilages are found, either the articulated Bones are of such a Figure, or so joined and fixed by their Ligaments, that little Motion would be allowed without such Cartilages ; or else some Motions are necessary to the right Use of the Member, which the Form of the Articulation would not otherwise admit of. This will more fully appear after the other Articulations with such Cartilages are described \*.

After this Description of the Incasement of the Teeth, and the Mechanism of the Muscles, which

---

\* Vid. Edinburgh Medical Essays, Vol. 1.

act principally on this Bone, and those of the Os Hyoides, the Connections of the membranous Ligament, of the Tongue to the Maxilla, and its Motions, it is easy to see that the inferior Maxilla is the principal Instrument in Mastication, Deglutition, and Speech.

The TEETH come next to our Consideration. They are the Furniture of the Maxillæ, and are very hard, osseous Substances, fixed in their proper Cavities in them in the Manner of Nails. This Kind of Articulation is called Gomphosis. In regard to the Teeth we are to consider their Situation in deep Sockets, and their Connections, by means of the Periosteum and Gums. Their natural Colour is white, their Number from Twenty-eight to Thirty-two, viz. Fourteen, Fifteen or Sixteen in each Maxilla.

\*The broad thick Part of the Teeth, which appears without the Socket, is the Basis or Body. The smaller Processes sunk into the Maxillæ, are the Roots or Fangs. At the Place where the Base ends, and the Roots begin, there is generally a small circular Depression, which some call the Cervix or Collar. Each Tooth is composed of two Substances, its Cortex, and an internal bony Substance. The Cortex has no Cavity or spongy Substance for Marrow, and is so solid and hard, that Saws or Files, can with Difficulty, make Impression on it ; notwithstanding the great Hardness of this Cortex, it is wasted by Attrition. The internal Substance of the Teeth is osseous, with its Fibres running straight, according to the length of the Teeth, which, when exposed to the Air, by the breaking or falling off of the hard Cortex, must soon corrupt or be destroyed, as is the Nature of all Bones ; and thence carious

---

\* Description of the Teeth according to MONRO,



Teeth are often quite hollow within, when a very small Aperture appears only externally. The osseous Substance of the Teeth, has a Canal formed in its Middle, wherein their Nerves and sanguiferous Vessels are transmitted; which they certainly need, being constantly wasted by the Attrition, they are subjected to in Mastication, and for their farther Growth after they first appear. And it is certain, that they are capable of becoming longer and broader in Adults; which does remarkably happen when any Tooth of a young Person is taken out; for then the opposite grows longer, and those on each Side of the empty Socket, become broader; so that when the Maxillæ are brought together, it is scarce observable, where the Tooth is wanting. The Root of each Tooth has a distinct Canal with Vessels and Nerves within it. The State of these Nerves bears a strong Resemblance to that of the Cutaneous, which serve for the Sensation of the Touch. It is certain, as INGRASSIAS justly affirms, that they are capable of becoming longer and broader in Adults; which does remarkably happen, when any Tooth of a young Person is taken out: For then the opposite one becomes longer, and those on each Side of the empty Socket turn broader; so that when the Jaws are brought together, it is scarce observable where the Tooth is wanting.

The Vessels are easily traced as long as they are in the large Canal, but can scarce be observed in their Distribution from that to the Substance of the Teeth of Adults: RUYSCH however affirms that he could, after Injection, trace the Arteries into the hardest Part of the Teeth. And LEWENHOEK \* suspected the Fibres of the Cortex to

---

\* Arcan. Natur. Continuat. Epist. p. 3.

be Vessels. In Children I have frequently injected the Vessels of the Teeth as far as the Base: And in such as are not entirely ossified, one can with a lucky Injection fill so many Vessels, as to make the Inside of the cortical Part appear perfectly red. This plentiful Supply of Vessels must expose the Teeth to the same Disorders that attack other vascular Parts; and such Teeth as have the greatest Number of Vessels, must have the most numerous Chances of being seized with these Diseases.

Every Root of each Tooth has such a distinct Canal with Vessels and Nerves in it. These Canals in the Teeth with more than one Root, come nearer each other as they approach the Basis of the Tooth, and at last are only separated by a very thin Lamella, which being generally incomplete, allow a Communication of all the Canals, and frequently one common Cavity only appears within the Basis, in which a pulpy Substance composed of Nerves and Vessels is lodged. And since the Cuticula can be rubbed off or cut without Pain, allows the Nerves to be affected by Heat or Cold, and transmits acid or austere Liquors, that blunt the Touch considerably, and give an uneasy Sensation at the same time; and that several Substances, notwithstanding this interposed Membrane, do create a painful Tremor, by their numerous or frequently repeated Impulses. When, I say, all this is considered, the analogous Phænomena in the Teeth, which the Antients disputed so much about, will appear to be of no difficult Solution.

In young Subjects, different Stamina or Rudiments of Teeth are to be observed within the same Alveoli, those next the Edge of the Gums hinder ordinarily the deeper seated ones from making their Way out, while these prevent the former from sending out Roots, or from entering deep in-

to

to the osseous Alveoli of the Maxilla by which they come to be less fixed.

The Entrance of the Canals for these Vessels, is a small Orifice, to be seen a little aside of the extreme Point of each Root ; sometimes (especially in old People) this Foramen is intirely closed up, and consequently the Nerves are destroyed, as M. DE LA HIRE jun. of the Academy of Sciences at Paris, has remarked.

The Teeth are seen for a considerable time, in Form of Mucus, contained in a Membrane, afterwards a thin cortical Lamina, and some few osseous Strata appear within the Membrane, with a large Cavity filled with Mucus in the Middle, and gradually this exterior Shell grows thicker, the Cavity decreases, the Quantity of Mucus is lessened, and this Induration proceeds, till the whole Body is formed, from which the Roots are afterwards produced.

Children seldom have Teeth appearing without their Gums, when new born, but when they are two Years old, or little more, they have twenty, and their Number does not increase till about seven Years of Age, when the Teeth, that first made their way through the Gums, are thrust out by others, that have been formed deeper in the Jaw, and some more of the Teeth begin to discover themselves, farther back in the Mouth. About fourteen Years of Age, some more of the first Dentition are shed, and the Number is increased. This shedding of the Teeth is of good Use ; for if the first had remained, they would have stood at a great Distance one from another, because the Teeth are too hard in their outer Crust to increase so fast as the Maxillary Bones do ; whereas both the second Stratum, and the Teeth that come out late, meeting (while they are soft) with a considerable Resistance to their Growth, in Length  
from

from those situated upon them, will necessarily come out broad, and fit to make that close Guard to the Mouth which they now form.

Tho' the Teeth so far agree in their Structure, yet because of some Particulars, wherein they differ, they are generally divided into three Classes, viz. Incisores, Canini, and Molares. The Incisores are the four anterior Teeth in each Maxilla receiving their Name, from their Office of cutting our Aliment, for which they are excellently adapted, being each formed into a sharp cutting Edge at their Bases, by the Extremity of their anterior Side turning inwards, while the posterior Surface is sloped down and hollowed; so that they have the Form of Wedges; and therefore their Power of acting must be considerably increased, as is demonstrable in Mechanics.

Seeing the Action of the Incisores, a perpendicular Compression is only necessary, without any lateral Motion, they are not so firmly fixed in their Alveoli as the other Teeth are, having neither so many nor so long Roots, but are only possessed of one short Stump. The Incisores of the superior Maxilla, especially the two middle ones, are broader and longer than those of the inferior Maxilla.

In a new-born Infant, the Cortex Body of these Teeth is only hardened.

CANINI, from the Resemblance to Dog's Tusks, are one on each Side of the Incisores in each Maxilla. The two in the superior Maxilla are called Eye Teeth, from the Communication of Nerves, which is said to be betwixt them and the Eyes. The two in the inferior Maxilla are named Angular or Wike-Teeth, because they support the Angles of the Mouth. The Bases of the Canini are broader than those of the Incisores, though they are also sloped on the interior Side. They are longer than  
any

any other Teeth, and stronger than those of the former Class. The Canini of the superior Maxilla are the largest and longest, and have the Extremity of their Roots crooked, and so are more firmly secured in their Alveoli. Hence it is evident how well these are adapted for breaking and bruising solid Bodies; this being a Sort of mixed Action, between Cutting and Grinding, the proper Offices of the other two Classes. The Canini of a Child are formed much in the same manner as the Incisores are.

The DENTIS MOLARES or Grinders, which have got their Name because they grind our Food, are generally five in each Side of each Maxilla, in all twenty. They are the broadest Teeth of any, with both Sides equally raised or nearly so, but are unequal and scabrous at their Bases, to be the better fitted for their Office. The Body of the first is generally the least, and comes nearest to the Canini in its Shape; the third and fourth are the largest, and the fifth is next in Size to them.

Some of the Molares have only one Root, others have, two, three, four, or five to prevent their loosening by the lateral Pressure, which they suffer; and in the superior Maxilla, their Roots are commonly more numerous, and more separated than in the inferior, because the superior Teeth are more liable to fall out, by their Situation and the Structure of their Alveoli, as GALEN has observed. The Number, however, of the Roots of each of them is very uncertain, sometimes they are more, sometimes fewer, frequently several Roots are united, at other Times they are all distinct. The Disposition of such as are distinct is also various; for in some, the Extremities of the Roots go out strait, in others they separate, and in others again, they are crooked inward. In general, we observe, that the farther back in the Mouth

Mouth these Teeth are situated, the Number of Roots is greater, and when they are united, we can still distinguish them, by observing the Number of small Apertures at their Points, which determine the Number of Roots, the Tooth ought to be reckoned to have. The cortical Substance at the Basis, of the Grinders, is thinner than in any other Teeth. The two Teeth that are placed farthest back in each Maxilla, are distinguished by the particular Name of *Dentes Sapientiæ*; because they commonly cut the Gums about the twenty-first Year of our Age, when the Laws allow People to be *Sui Juris*, and capable to manage their own Affairs; their Bodies are smaller, and their Roots are not generally so numerous as in the third and fourth. At the Time of Birth, only two *Dentes Molares* in each Maxilla, have begun to ossify, and that at little more than the Basis, which has several sharp Points standing out from it. The Teeth are principally fastened into their Alveoli by the Means of the Gums, except the *Molares* and *Dentes Sapientiæ*, which are fastened by *Gomphosis*; and some Anatomists have described the Articulation of the others by the Means of *Sypharosis*; as it appears by their falling out, when the Gums are any ways attacked in scorbutic Diseases or Salivation. The Uses of the Teeth are to masticate our Aliment, and assist us in Pronunciation; besides the Ornament to the Mouth.

From what has been said, the Answers to the following Queries may easily be given.

Why in Children do the *Dentes Scisores* first cut the Gums, the *Canini* next, and *Molares* last?

Why do Children shed their Teeth at a certain Age?

Wherefore have these temporaneous Teeth generally no Roots, or very small ones?

Why have these first Teeth sometimes Roots?

Why do these Roots frequently come thro' the Gums?

Whence come Butter and Buck Teeth?

How do these Teeth sometimes go into the narrow Row with the others, after pulling out a rotten Tooth near them?

How have some People got two Rows of Teeth in one or both Jaws?

Why do the Teeth of old People loosen, and drop out intire?

Whence arise the new Sets of Teeth which several old People obtain?

Why are not the Gums of toothless old People torn by the hard Sockets in chewing?

Why are the Teeth insensible when slightly filed or rasped?

How come they to be sensible of Heat or Cold, to be set on Edge by Acids, or to give such an uneasy Sensation, when gritty or sandy Substances are rubbed between them?

What is the Reason of some Persons dying convulsed, upon rasping or filing down an overgrown Tooth?

What Parts are affected in the Tooth-ach?

Why are the Dentes Molares most subject to that Disease?

How do the Teeth break and moulder away without any Pain in some People, and not in others?

Whence proceeds the violent obstinate Hæmorrhagy which sometimes attends the drawing of Teeth?

Why is it more difficult and dangerous to draw the Eye-teeth than any other?

What makes it impossible frequently to draw Grinders without bringing away Part of the Jaw-bone with them, or breaking the Fangs?

Why

Why have small Worms been sometimes found in carious Teeth?

A Particular Description of the FORAMINA of the CRANIUM, according to HEISTER.

The Apertures in the Cranium are to be divided into external and internal; by the external, we mean those which are most conspicuous on its external Surface: By the internal, those which are most obvious in the internal. Of the larger internal Foramina, or Apertures, we count eleven Pair, affording Passage to the Arteries, Veins, and Nerves of the Brain; and besides these, we are to remark the Magnum, which is a single one; viz. a Branch of the fifth Pair, to the emissary Foramen of the occipital Bone, which gives Passage to the Medulla Spinalis, and with it to the accessory spinal Nerves, and to the vertebral Arteries.

We are to pay a particular Regard to the first Pair of these Foramina (which may indeed be called more properly a Congeries of the Foramina of the Os Cribrosum. These give Passage to the Filaments of the first Pair of Nerves, called the Olfactory Nerves. The second Pair is in the sphenoid Bones, and gives Passage to the Optic Nerves. The third Pair are called the lacerated Foramina, and give Passage to the third and fourth of Nerves, first Branch of the fifth Pair, and to the sixth Pair, as also to the Emissary of the Receptacles of the Dura Mater. The fourth Pair are in the sphenoid Bone, and give Passage to the second Branch of the fifth Pair of Nerves, which is distributed to the several Parts of the superior Maxilla. The fifth or oval Foramina gives Passage to that of the Dura Mater. The sixth is a very small Foramen, and admits an Artery, which is distributed over the Dura Mater, and is that which forms



forms the Impressions of little Shrubs or Trees on the internal Surface of the Parietal Bones. The seventh is placed between the Sella Equina and Petrose Apophysis, and transmits no Vessels, being obstructed by the Dura Mater. The eighth Pair of Foramina give Passage to the Carotid Arteries, whence it is called the Carotid Foramina; and the intercostal Nerve has its Egress also at this Opening. Through the ninth, which is in the Os Petrosus, passes the auditory Nerve. Through the Tenth, which is between the Os Petrosus, and the Occipital Bone, pass the Par Vagus, and the lateral Sinuses of the Dura Mater, together with the Spinal Nerve. The eleventh is in the Os Occipitis, near the Edge of the Foramen Magnum; and thro' this passes the ninth Pair of Nerves called the Lingual.

Besides these Foramina, there are also a Number of little ones in the Os Petrosus, often very conspicuous. One of these returns a Branch of the auditory Nerve to the Dura Mater; and the other principal one transmits the sanguiferous Vessels to the Labyrinth or the internal Organ of Hearing.

In the external Foramina of the Cranium, there are two proper ones of the Os Frontis, a little above the Orbits. These are, from their Situation, called Supraorbitalia: They give Passage to the ophthalmic Nerve of WILLIS; but in their Place, we often meet with only a superficial Incisure. Besides these, there are four other Foramina, common to the Os Frontis, and to the Plane or Papyraceous Bones of the Orbit: Two of these are placed on each Side, and they transmit little Nerves and Vessels to the Sinuses of the Ethmoid Bone.

In the Parietal Bones there is one which serves for the Passage of a Vein from the Cutis of the Cranium into the sagittal Sinus to the external Veins of the Head: This, however, is often want-

ing; and many Anatomists therefore do not mention it.

In each of the Temporal Bones, there are three common Foramina: The First of these is the Foramen Jugale, which serves for the Passage of the Crotaphite Muscle; a Second is large, in which is the Sinus of the Jugular Vein; and the Third is the Ductus Eustachii, already mentioned, situated between the Petrosium and Sphenoides, and leading from the Mouth into the internal Ear. Besides these common Apertures of the Temporals, there are also three proper ones; First, The Meatus Auditorius or Auditory Passage. Secondly, The Aqueduct of FALLOPIUS, situate between the Mastoid and Styloid Process, and transmitting the hard Portion of the Auditory Nerve. Thirdly, A Foramen behind the Mastoid Process, serving for the Ingress of a Vein into the lateral Sinus, or for the Egress of one from the lateral Sinus to the Veins of the Occiput.

In the Occipital Bone, there are two Foramina, situate behind the Condylöid Apophyses, and serving to give Passage to the Vertebral Veins into the lateral Sinuses of the Dura Mater: These Foramina, however, are wanting in many Crania.

In the Sphenoides, besides the internal ones already described, and the Apertures of the Sinuses into the Nostrils common to them, with the Bones of the Palate, and which are the Apertures of the Nares and Fauces, there is another Canal in the superior Part of the Pterygoid Processes, serving for the Passage of the Novum Emissarium of the Dura Mater.

In the Os Ethmoides, there are, First, Those common to this Bone with the Os Frontis, situated anteriorly in the Orbit, and already described. And Second, the Apertures of the Ethmoid Sinuses into the Nostrils.

The

The Foramina of the superior Maxilla are, First, One called the Anterior of the Palate, situate behind the foremost Dentes Incisores, and opening into the Nostrils.

But this is usually so closed up in living, and even in dead Subjects, by the Membrane of the Palate, that nothing of its Aperture is distinguishable within the Mouth; nor is it certainly known, that any Thing is transmitted thro' it. It is also to be observed, that as the Membrane of the Mouth, is evidently joined to that of the Nostrils, by means of this Canal, a very sufficient Use of it may be the making the Union between that Membrane, and that of the Palate, the stronger.

Secondly, the Infra Orbitale : Its Use is to give Passage to the Fifth Pair of Nerves. Thirdly, There are other Foramina behind the posterior Molares, through which the Vessels and Nerves pass to the Maxillary Sinuses. Fourthly, There is an Incisure in the exterior Side of the Bottom of the Orbit, common to this, and to the Sphenoid Bone, and serving to give Passage to the Vessels going to the Eyes and Nose. The Fifth is the Nasal Canal, common to this Bone and the Os Unguis. The Sixth are the Apertures of the Sinuses into the Nostrils. And the Seventh is the posterior Foramen of the Palate common to this Bone, with that of the Palate, and serving to convey the Nerves to the Palate.

In the Os Jugale there are, First, The Jugale or common Foramen. Secondly, The proper Foramen of the Jugale, which is sometimes single, sometimes double, and serves for the Passage of a Nerve.

In the Os Palati, besides the Foramen common to that, with the adjacent Bone, there is a proper one, situate near where it is connected to the

Pterygoïd Processes, and serving for the Passage of Nerves to the Palate.

In the Maxilla inferior, there are two Foramina, in the internal Surface, serving for the Passage of an Artery, a Vein, and a Nerve, into the very Substance of the Maxilla, for its Nutrition, and that of the Teeth; and there are also two in its external Surface, which serve to give Egress to the same Vessels, which are thence distributed to the Gums and the Chin.

In the Examination of different Crania, other Foramina besides these will occasionally be found in different Places. These are either extraordinary, and *Lusus Naturæ*, as is often the Case; or they are otherwise such as serve only to give Passage to Vessels, serving for the Nutrition of the Bones in which they are distributed

According to the Division made of the Skeleton, we should now proceed to the Description of the Trunk, but must first examine a Bone, which cannot well be said to belong to either the Head or the Trunk; nor is it immediately joined to any other, and therefore is very seldom preserved with Skeletons; however it is generally described by Anatomists after the Bones of the Face: In Obedience, therefore, to the prevailing Method, we shall at present examine its Structure.

Os Hyoïdes, is situated horizontally between the Root of the Tongue and the Larynx; and is likewise called Os Linguae, Bicornis, &c: In young Subjects this Bone is divided into three Portions, and therefore for the better understanding its Structure, we shall distinguish it into Basis, Cornua, and Appendices. Its Basis, or Body, occupying its middle Part, and two lateral ones called Cornua; it is to these that the Tongue is connected. In Adults there are often, at the Junctions of these with the  
Base,

Base, two other Fruſta, very ſmall, and thence overlooked by moſt Anatomists, theſe are nearly of the Shape of a Wheat-Corn, and may thence be called *Oſſa Triticæ*.

When the Body of the *Os Hyoïdes* joins on each Side with its *Cornua*, a ſmall ſtyliform Proceſs riſes upward and backward, into which the *Muſculi Stylo-Hyoïde Alteri* and Part of the *Hyo Gloſſi* Muſcles are fixed. Theſe Appendices frequently remain cartilaginous many Years.

The Subſtance of the *Os Hyoïdes* is cellular, but covered with a firm external *Lamina*, which is of ſufficient Strength to bear the Actions of ſo many Muſcles as are inſerted into it. It is not articulated with any Bone of the Body, except by means of the Muſcles and Ligaments mentioned. The Uſe of the *Os Hyoïdes* is to ſerve as a ſolid Lever, for the Muſcles to act with, in raiſing and depreſſing the Tongue and Larynx; or in enlarging and diminifhing the Capacity of the Fauces.

As Four Cartilages of the Larynx, often oſſify in old People, many have reckoned them among the Number of the Bones; they are called the *Thyroïdes*, the *Cricoïdes*, and the two *Arytanoïdes*. The Nature and Uſe of theſe Parts, however, are much better underſtood when we examine them on recent Subjects, than when in the Skeleton, of which at beſt they make but an improper Part.

We obſerve all the Bones of the Cranium are found to be incomplete in new-born Infants. The Sinus and its *Diploë*, or *Meditullium*, are almoſt intirely wanting; that the oſſeous Fibres in the Formation of moſt of them, are carried in Rays, from a Center towards the Circumference, and generally are not ſingle as in Adults; but compoſed each of ſeveral Fruſtules, or little Pieces; nor are the Sutures at that time formed; final-

ly there are triquetrous little Bones between them\*. In Adults, the several Bones of the Cranium are in general articulated by Sutures: These Sutures are either common or proper; the proper ones are distinguished into true and false, or spurious; they are called true Sutures, when the Bones are connected in an amazing Manner, by means of a Multitude of inequal denticulated Eminencies, forming an Appearance somewhat like the Edge of a Saw: These Denticulations enter mutually into each others Sinuses, plainly visible externally, and are distinguished as follows, viz.

The proper ones are, 1st, The SUTURA CORONALIS, which runs across the Cranium, from one superior Edge of the Sphenoid Bone to the other, and connects the parietal Bones to the frontal.

2dly, SUTURA SAGITTALIS, connects the Parietal Bones; begins at the Os Occipitis, and is continued to the Os Frontis, in Children down to the Nose; the Os Frontis in them, being two Bones, and sometimes so in adult Bodies.

3dly, SUTURA LAMBDÖIDALIS, connects the back Part of the Ossa Bregmatis or Parietal Bones, to the superior Part of the Occipital: In this Suture are frequently observed some small Bones called Ossa Triquetra, and sometimes in other Sutures.

The common ones are, 1st, SUTURA SQUAMOSA, which is made by the superior Part of the Temporal and Sphenoid Bones wrapping over the inferior Edges of the Parietal Bones.

2dly, SUTURA TRANSVERSALIS, which runs across the Face, through the Bottoms of the Or-

\* These Bones are called by some Ossa Triquetra or Ossa Wormiana. HEISTER has preserved a Cranium, in which the Lambdöidals were two Inches broad, and there were more than twenty of these distinct Bones.

bits of the Eyes; it connects the inferior Edge of the Frontal Bone, to the *Ossa Nasi, Ungues, Palatina, Palati, and Jugula* or *Malarum*. Some Authors mention also a Number of other common Sutures, such as the *Nasal, the Palati, the Lachrymal, and the like*; but these are called by the Ancients *Junctura per Harmoniam*; which comprehend the Bones of the Face.

The Use of the Sutures, is, 1st, that the *Dura Mater* may in those Places, be very firmly connected to the *Cranium* and *Pericranium*. 2dly, That in Infants, the Head may be more easily extended in its Growth, from the several Bones, being at that Period disunited at these Places. 3dly, That the Transpiration from the Brain, may be the more free and easy, at that time of Life in which they are open, and at which also the Habit is more humid. 4thly, That very large Fractures of the *Cranium* might be in some measure prevented. And, Lastly, There is another Disadvantage in their Openness in Children, namely, that medicinal Applications, to the external Part of the Head may penetrate and do Service; and in the Time of Delivery, yield by Compression in the Passage.

#### SYNSTEOGRAPHY: OR, THE CARTILAGES AND LIGAMENTS OF THE HEAD, &c.

The *Condyloid Apophyses* of the *Os Occipitis*, the *Glenoid Cavities* or *articular Fossulae* of the *Temporal Bones*, the *Eminencies* next these Cavities, and the *Condyloid Apophyses* of the inferior *Maxilla*, are all crufted over with very white and smooth Cartilages; and there is likewise an inter-articular, or moveable Cartilage in each Articulation of the inferior *Maxilla*, with the *Temporal Bones*.

This Cartilage is thick near the Circumference, very thin and transparent, and sometimes perforated in the Middle.

The inferior Side is uniformly concave, answering to the oblong Convexity of the Maxillary Condyle; but the superior Side is partly concave, and partly convex, suited to the Fossula and Eminence in the Temporal Bone. The Mechanism of this Cartilage shall be explained in the Description of the Muscles.

The remaining Cartilages of the Bones of the Head, viz. The cartilaginous Septum and other Cartilages of the Nose, the small cartilaginous Ring in each Orbit, the Cartilages of the external Ear, and those which are connected to the Os Hyoides, must be referred to the Description of the Part.

The Ligaments of the Bones of the Head are these: 1st, Those between the Occipital Condyles, and the superior Apophysis of the first cervical Vertebra. 2dly, Those between the Os Occipitis and Apophyses Dentiformis of the second Vertebra. 3dly, Those of the Articulation of the inferior Maxilla, with the Temporal Bones. 4thly, those by which the Os Hyoides is connected to the Styloid Apophyses\*.

The Ligaments of the Occipital Condyles resemble the articular Ligaments of the Vertebrae, consisting of a strong Texture of ligamentary Filaments, placed close by each other round the whole Articulation, and fixed by one End in the occipital Bone, by the other in the superior Apophyses of the first Vertebrae, and surrounding the capsular Ligaments.

---

\* I here pass over the Ligaments which connect the Cartilages of the Ear, those of the Nose, the small cartilaginous Pullies of the Orbits, and the ciliary Cartilages.



The Ligaments which go from the Os Occipitis to the Apophyfis Dentiformis are very thick, and disposed in separate Fasciculi which afterwards unite.

The Fasciculi are fixed immediately before the great occipital Foramen, in the inferior Side of the Apophyfis Basilaris, and the united Ligament is inserted in the odontoid Apophyfis, in the manner already mentioned.

The Ligaments of the Articulation of the inferior Maxilla are very strong, and are disposed and inserted much in the same Manner with those by which the Clavicle is connected to the Sternum. They are fixed by one Extremity round the glenoid Cavity, or articular Fossula, and Eminence of each temporal Bone, by their Middle, round the inter-articular Cartilage, and by the other Extremity, round each Condyle of the inferior Maxilla. The Disposition of the capsular Ligament, with respect to the inter-articular Cartilage, is the same as in the Articulation of the Clavicle, with the Sternum.





## LECTURE VI.

### The BONES of the TRUNK.

**T**HE TRUNK comprehends all the Bones, which in a natural State lie between the Head and the four Extremities. These Bones are divided into three Parts; the Spine, Thorax, and Pelvis; the first of which, that is, the Spine, may be looked on as a common Part, the other two as proper.

#### THE SPINE AND VERTEBRÆ IN GENERAL.

By the SPINE is meant all that Order of Bones, which follow one another without Interruption, from the Os Occipitis downward, along the posterior Part of the Trunk. It represents a very compound folding Pillar, round on the anterior and on the posterior Side stuck full of Prickles or Points, representing so many particular Spines; having a Canal in the Middle, through its whole length, into which a great Number of Foramina open on each Side.

When it is viewed directly on the anterior or posterior Side, it appears strait, and to be composed of different Portions of Pyramids in a contrary Situation to each other; but viewed laterally it presents several different Curvatures.

The Pieces which form the Spine are of two Kinds; one single, the other compound. The single are generally twenty four in Number, called by the  
Name

## Lect. vi. The Bones of the Trunk. 107

Name of Vertebrae, from the Latin Word *Vertendo*, turning. The compound Pieces are two, the *Os Sacrum*, and *Os Coccygis*; the single Pieces are likewise called True Vertebrae, to distinguish them from the Portions which compose the other two, which are called False Vertebrae.

The true VERTEBRÆ are divided into three Classes, viz. Seven cervical, twelve dorsal, and five lumbal Vertebrae.

To have a clear Idea of the Structure and Disposition of each Vertebra, we must first examine what they have in common, and next, what is peculiar to the Vertebrae of each Class, or to any particular Vertebra therein: Afterwards, the Description of the Portions which compose the *Os Sacrum* and *Coccygis* will complete this first Part of the Trunk.

What is common to all the Vertebrae, may be reduced to their external Conformation, external Structure, Connection, and Uses.

In the Vertebrae in general, we are to consider the Body, Apophyses, and Cavities.

By the Body of the Vertebrae, we mean that principal Part or large Mass, situated anteriorly, and which supports all the other Parts. In most of the Vertebrae, the Body represents a Portion of a Cylinder cut transversely, the Circumference of which is more or less round on the anterior, and sloped on the posterior. It has two Sides, the superior and inferior; each of which is, as it were, bordered by a thin Lamina in Form of an Epiphysis.

The Apophyses in most of the Vertebrae are seven in Number; one posterior, called the Spinal Apophysis, which ends in a small Epiphysis, and has given the Name to the whole System of the Vertebrae: Two lateral, called Transverse Apophyses: And four, which are likewise lateral;

two on each Side, one above, and one below. They are called by the general Name of Oblique Apophyses, and distinguished into superior or ascending, and inferior or descending. These four are the least of all the Processes of the Vertebrae, and each of them has a cartilaginous Side. I should chuse to call them articular rather than oblique Apophyses, for a Reason which shall be afterwards given, and I sometimes name them likewise the small Apophyses of the Vertebrae.

The Cavities in the Vertebrae are three large middle Foramina between the Body and the Apophyses. Four Scissures, two on each Side, one superior and small, and one inferior, which is larger. The great Foramen is Part of the vertebral or spinal Canal or Duct, and the Scissures of one Vertebra meeting those in another, form the lateral Foramina, which communicate with the Canal.

Though the Situation of the Vertebrae has been already mentioned pretty exactly, it will be proper to repeat it once more.

The Body is the anterior Part of each Vertebra; the Spinal Process, the posterior Part; the transverse and oblique, or articular Processes, are the lateral Parts; and the great Foramen is in the Middle of all these Parts.

The inner Substance is spongy, or like a Diploë, covered externally with a complete Substance, which, in the Body of the Vertebrae, is very thin, but thicker in the Processes.

The Vertebrae are joined together by their Bodies, and by their small Apophyses. The Bodies in a natural State are principally united by a cartilaginous Symphysis, that is, by the Intervention of a pliable and elastic Cartilage, as shall be explained: This cartilaginous Connection makes the lateral Foramina of the Spine larger in the Body  
than

than in the Skeleton, where these Cartilages are wanting.

Their Connection by the small Apophyses, is by Arthrodia, and not by Ginglymus, as shall be demonstrated. These two Articulations are secured by very strong Ligaments.

#### OF THE CERVICAL VERTEBRÆ.

The CERVICAL VERTEBRÆ are the seven superior; which are distinguished from the rest by these Marks. They are all, except the first, of near an equal Breadth: Their Bodies are smaller and more solid than any others, and flattened anteriorly, to make way for the *Æsophagus*. The posterior Surface, which is also flat, is generally rough, or has small Processes rising from it, where the Ligaments are fixed.

The superior Surface of the Bodies of each Vertebra is made concave, by a slanting thin Process raised on each Side.

The inferior Surface is also excavated, but in a different Manner from the former; for the posterior Edge is raised a little, and the anterior is produced a considerable Way. Hence we see how the Cartilages between those Bones, are more firmly connected, and the Articulations of any two Vertebrae, are more secure.

The Cartilages between these Vertebrae are thicker, especially in respect of their Bulk, than those belonging to the Vertebrae of the Thorax, because of the larger Motion that is allowed here, and they are thickest anteriorly; which is one Reason why they advance forward as they descend.

The oblique Processes of these Bones of the Neck more justly deserve that Name, than those of any other Vertebrae. They are situated slanting; the superior Processes, having their smooth and almost flat Surfaces, facing obliquely, posteriorly,

## 110 The Bones of the Trunk. Lect. vi.

riorly; and superiorly, while the inferior oblique Processes, have their Surfaces facing obliquely, anteriorly, and inferiorly.

The transverse Processes of these Vertebrae, are framed in a different Manner from those of any other Bones of the Spine: For besides the common Process, rising from between the oblique Processes of each Side, there is a second that comes out from the Side of the Body of each Vertebra; and the two Processes, after leaving a circular Foramen, for the Passage of the cervical Artery and Vein, being united, are considerably concave superiorly, with rising Sides to protect the Nerves, that pass in the Cavity; and at last each Side terminates in an obtuse Point, for the Insertion of Muscles.

The spinal Processes of these cervical Bones, stand nearly strait posteriorly, are shorter than those of any other Vertebrae, and are perforated, or double at their Extremity; and hence allow a more convenient Insertion to Muscles, and a larger posterior Motion.

The Foramina between the osseous Curvature for the Passage of the Nerves from the Medulla Spinalis, have their largest Share formed in the inferior of the two Vertebrae, to which they are common.

The Substance of the Cervicals, especially of their Bodies, is not so porous or tender as that of the other two Classes.

So far the cervical Vertebrae agree in their general Characteristics, but still have some particular Difference, which oblige us to consider them separately. The First, from its Use of supporting the Head, has got the Name of Atlas, and by several Authors is called Epistrophe, from the Motion it performs on the second.

The

## Leſt. vi. The Bones of the Trunk. III

The Atlas, contrary to all the other Vertebrae of the Spine, has no Body nor ſpinal Apophyſis.

The Foramen, or Opening, in it is much larger than the reſt. It looks like an irregular bony Ring filled all round with Eminencies and Cavities. It may be divided into two Arches; the anterior or largeſt, and poſterior or ſmalleſt.

The anterior Arch is formed by two thick lateral Portions and a ſmall Curve middle Part, which, with the other two, makes a Sciffure in the anterior Part of the great Cavity of the Vertebra. The lateral Portions may be looked upon as a Body in two Parts; without which, the firſt Vertebra would have been too weak to ſuſtain the Articulations. In the Middle of the convex Side of the poſterior Curvature is a Tubercle a little pointed, larger than the anterior Tubercle, and marked with muſcular Impreſſions on each Side, and on the ſuperior and inferior Edge. This Tubercle ſeems to be in the Place of a ſpinal Apophyſis.

The tranſverſe Apophyſes of the firſt Vertebra ariſe from the Middle of the lateral Portions, being perforated perpendicularly at their broad Origins. They are much longer than thoſe of the five Vertebrae below them, and contracting gradually, they terminate in an obtuſe Point, which is ſometimes in a Manner double, and marked on the ſuperior and inferior Side with muſcular Impreſſions.

The ſuperior articular Apophyſes, are larger than any other of the ſame Kind in the whole Spine. They are oblong cartilaginous Cavities framed in the ſuperior Side of the lateral Portions. Their Situation is almoſt horizontal, and their anterior Extremities, are turned more internally, that is, nearer

## 112 The Bones of the Trunk. Lect. vi.

nearer one another, than the posterior. They are in a word, every way proportioned to the Condyles of the Os Occipitis.

The inferior articular Apophyses are less concave, shorter, and broader; they are inclined laterally from the internal to the external, and from the superior to the inferior. They are directly under the superior Apophyses; and thus the articulate and transverse Apophyses, the Foramina and lateral Portions; on each Side, are all in the same Line.

There is a long Scissure, or kind of Groove, between each superior articular Apophysis, and the posterior Curvature of the bony Ring, reaching from the Foramen, in the transverse Apophysis posteriorly: In which Scissure, the vertebral sanguiferous Vessels, in the natural State, make a Turn, before they enter the greatest occipital Foramen. Sometimes, though very rarely, there is a complete Foramen in the Room of this Groove. There is another Scissure but more shallow, on each Side, between this Curvature and the inferior Apophysis.

In the internal Circumference of the great Foramen of this Vertebra, in the Middle of the great Scissure, is a cartilaginous Impression, for the Articulation of the Axis of the second Vertebra; and on each Side of that Scissure: Between the superior and inferior Apophyses, there is another small Impression, for the Insertion of a transverse Ligament, which secures the Axis in its Place. All round this Circumference, both toward its superior and inferior Edges, there are many other Inequalities or Impressions.

In new-born Children, this Vertebra has only the two lateral Pieces ossified, the anterior Curvature, which it has instead of a Body, being cartilaginous. The second Vertebra of the Neck  
is



## Lect. vi. The Bones of the Trunk. 113

is very different from the first; its Body is narrower and longer than that of the following Vertebrae, and its Length is increased on the superior Part by an Eminence like a Pivot, or Axis; called by the Greeks *Odontoides*, by the Latins *Dentiformis* or simply *Dens*.

In this Axis four Impressions or Marks are observable; one anterior, which is cartilaginous, for its Articulation, by a like Impression, with the great Scissure in the first Vertebra; one posterior, for the Insertion of the transverse Ligament; two superior, which unite at the Point of the Axis, and serve for the Insertion of the Ligaments, by which the Axis is fastened to the anterior Edge of the Occipital Foramen. The superior Portion of the Axis is a true Epiphysis grafted upon a forked Apophysis. The spinal Apophysis, is short, broad, and very much forked, being distinguished into two lateral Parts by a Kind of angular Crista. Its inferior Side is concave, and of an angular Cavity, which is divided into two lateral Parts, by an osseous Line.

The transverse Apophyses are very short, a little inclined inferiorly, and perforated obliquely; whereas in all the other Vertebrae these Perforations are perpendicular. When the Apophyses are thin, this Obliquity does not appear so much; but when they are thick, the Foramen is more like a true Canal, bent in such a Manner, that one Orifice is inferior, the other externally. The Apophyses themselves terminate in a Point turned downward.

The superior articular Apophyses do not answer exactly to the inferior Apophyses of the first Vertebrae. Their cartilaginous Sides are inclined obliquely, externally, and inferiorly; and as they are narrower than the former, and have their Margins more raised toward the exterior Side, a small

empty Space is commonly left between the two, on the posterior and anterior Parts in the Skeleton: The Reason of which shall be demonstrated in the next Lecture.

The superior Apophysis of this Vertebra, the transverse Processes of the first, and their Foramina, are all in the same perpendicular Line.

The inferior Apophyses are less, and situated more posteriorly; their cartilaginous Sides are turned in the same Manner very obliquely, inclined from the inferior to the superior, and from the anterior to the posterior; so that their Situation is more vertical than horizontal. They are likewise a little concave.

The superior Scissures are superficial, long, situated behind the superior Apophyses, and insensibly disappear, toward the spinal Apophyses. The inferior Scissures are situated more forward directly under the transverse Apophyses of their Foramina. The Body of this Vertebra has a very small Tubercle anteriorly.

This second Vertebra consists at the Birth of four Pieces: for besides the three which I already mentioned, as common to all the Vertebrae, the Odontoid Process of this Bone is begun at this Time to be ossified in its Middle, and is joined as an Appendix to the Body of the Bone \*.

The Conformation of the third cervical Vertebra is not very different from the rest in general, already described.

\* Here we may deduce one good Reason, why Nurses ought to keep the Heads of new-born Children, from falling too far backwards, by stay Bands, or some such Bandage, till the Muscles attain Strength sufficient to prevent that dangerous Motion. MONRO, on the Bones.

## Lect. VI. The Bones of the Trunk. 115

The superior Apophyses answer to the inferior of the second Vertebra, their cartilaginous Sides being a little convex and turned posteriorly. The inferior Apophyses are a little concave and turned anteriorly.

The transverse Apophyses are very short, and situated before the articular ones.

They are something forked and depressed on the superior Side, between the lateral Aperture and the Extremity. The Scissures are turned a little anteriorly, above and below the transverse Apophyses, and the inferior are deeper than the superior.

The fourth, fifth, and sixth Vertebrae are like the third, except that their Bodies are gradually more extended, but still concave on the superior Surface, and convex on the inferior; and that the spinal Apophysis of the sixth Vertebra is longer, thinner, and straiter, than the three above it.

The inferior Apophyses, of the fourth and fifth Vertebrae, and the superior of the sixth, are not so much inclined as those above them.

The Body of the last cervical Vertebra is the largest of all, so as has been already observed, all the seven represent a Sort of Pyramid set on the vertebral Pillar of the Back; the inferior Side of the Body of this Vertebra is almost flat.

The spinal Apophysis is long, almost strait, and very prominent; for which Reason it has been termed *Prominens* in Latin. It ends in a little flat Head, sometimes a little depressed or forked.

The transverse Apophyses of this Vertebra are longer, situated more posterior and less grooved than the former. Their Foramina are sometimes double, and in that Case less than when they are single; and sometimes there is an Aperture

## 116 The Bones of the Trunk. Lect. vi.

in them like a Sciffure, which Variety is also observable in the sixth.

The superior Apophyses, are like those of the other Vertebrae; but in the inferior, the Sides are more inclined and broader, answerable to the superior Apophyses of the first Dorsals.

In the six inferior cervical Vertebrae the middle Foramina are much larger than in the Dorsals. They are in some measure triangular, being broad on the anterior Side, and contracted on the posterior.

### OF THE DORSAL VERTEBRÆ.

They are twelve anteriorly, which may be distinguished from the other by the following Marks.

The Bodies of the Dorsals are longer than those of the Cervical, and in all of them (except the first, the superior Side of which is a little concave) both superior and inferior Sides are equally flat; this flattening on their Sides, which makes the Figure of the Vertebrae almost semi-oval, which affords a firmer Articulation to the Ribs, allows the Trachea Arteria to divide at a smaller Angle, and the other large Vessels to run secure from the Action of the vital Organs.

These Bodies are more concave behind than any of the other two Classes. Their superior and inferior Surfaces are horizontal.

The oblique Processes are placed almost perpendicular, the superior slanting but a little anteriorly, and the inferior as much posteriorly. Neither they, nor the oblique cervical Processes have as much Convexity or Concavity as is worth remarking. A small Roughness is observable at their Roots, where  
the

## Lect. vi. The Bones of the Trunk. 117

the Ligaments that surround their Articulations are inserted.

Between the oblique Processes of the opposite Sides, several acute Processes project from the superior and inferior Parts of the Laminæ, which join to form the spinal Process; into these sharp Processes, strong Ligaments are fixed for connecting the Vertebrae.

The transverse Processes of the dorsal Vertebrae are long, thicker at their Extremity than in the Middle, and turned obliquely backward, which may be owing to the Pressure of the Ribs, the Tubercles of which are inserted into a Depression near the Extremity of them.

The spinal Processes are long, small pointed, and run sloping inferiorly and posteriorly; from the superior Part of their posterior Surface, a small Ridge arises, which is received by a small Canal in the anterior Surface of the spinal Process, immediately above, which is connected to it by a Ligament. Hence but little Motion can be allowed of here, lest the Heart and Lungs should be disturbed in their Actions.

The Conduit of the Medulla Spinalis is here more circular, but corresponding to its Size, which is smaller than in any of the Vertebrae; and a larger Share of the Foramina, in the osseous Curvatures for the Transmission of the Nerves, is formed in the Vertebra above, than that below.

The Bodies of the four superior Dorsals deviate from the general Rule of the Vertebrae as they descend; for the first of these four is the largest, and the other three below gradually become smaller, to allow the Trachea and larger Vessels to divide at smaller Angles.

The proportionable Magnitude of the two little Depressions in the Body of each Vertebra,

## 118 The Bones of the Trunk. Lect. vi.

for receiving the Head of the Ribs seems to vary in the following Manner: The Depression on the superior Margin of each of them decreases as far down as the fourth, and after that increases.

The transverse Processes, are longer in each inferior Vertebra to the seventh or eighth, with their smooth Surfaces, for the Tubercles of the Ribs, facing gradually more inferiorly; but afterward as they descend become smoother, and the smooth Surfaces are directed more superiorly.

The Spinal Processes of the dorsal Vertebrae become gradually longer, and more slanting, from the first as far down as the eighth or ninth Vertebra, from which they manifestly return shorter and more erect.

The inferior articular Surface of the last Dorsal faces laterally externally, in order to be received into the superior articular Surface of the first lumbar Vertebra.

The eleventh often has the whole Cavity for the eleventh Rib in its Body, and wants the smooth Surfaces on each transverse Process.

The twelfth always receives the whole Head of the last Rib, and has no smooth Surface, its transverse Processes being very short.

### OF THE LUMBAL VERTEBRÆ.

They are Five which may be also distinguished from any others by these Marks, viz. First, Their Bodies, though of a circular Form, at their anterior Part, are somewhat oblong from one Side to the other, which may be occasioned by the Pressure of the large Vessels in embryo State, and of the Viscera contiguous to them. The Epiphyses on their Margins are larger, therefore the superior and inferior Surfaces of their Bodies. are more concave than in those of the Dorsals.

Second,

## Lect. VI. The Bones of the Trunk. 119

Secondly, The Cartilages between the Vertebrae are much the thickest of any, and render the Spine convex within the Abdomen, by their greatest Thickness at their anterior Part.

Thirdly, The oblique Processes are strong and deep; those in the opposite Sides being almost placed in parallel Lines, the superior (which are concave) facing the internal; and the convex inferior ones the external; therefore these Vertebrae receive each other above, and are received below, which is not so evident in the other two Classes already described.

Fourthly, Their transverse Processes are small, long, and almost erect, for allowing a sufficient Motion to each Bone, and Insertion to the Muscles likewise, to support and defend the internal Parts.

Fifthly, Betwixt the Roots of the superior oblique and transverse Processes, a small Protuberance may be observed, where the Muscles that raise the Trunk are inserted.

Sixthly, Their spinal Processes are strong, strait, and horizontal, with broad flat Sides, and a narrow Margin above and below, this last being depressed on each Side by Muscles. And at the Root of Margins, we see rough Surfaces for fixing the Ligaments.

Seventhly, The Canal for the Medulla Spinalis, which is divided here into a great Number of Nerves is rather larger in these, than in the Dorsal Vertebrae.

Eighthly, The Foramina for the Passage of the Nerves are more equally formed from the contiguous Vertebrae than in others; the superior one furnishes, however, the larger Share of it.

Both the transverse and spinal Processes of the middle lumbal Vertebrae are longest and thickest; above and below as they diminish: So that

these Processes of the first and fifth are the least, which is very necessary, especially as to the transverse ones of these two Vertebræ; for if they had been long, they would have struck on the Ribs or the *Ossa Ilium*, or would have bruised the interposed Muscles, in the Deflexions of the Spine externally.

The *EPIPHYSES* are round the Margins of the Bodies of those Vertebræ mostly rising in the two inferior, which consequently make them appear hollower in the middle, than the others.

The Body of the fifth is rather thinner than that of the fourth. The spinal Process of this fifth is smaller, and the oblique Processes face more posterior and anterior than in any other lumbar Vertebra.

The true Vertebræ serve to give us an erect Posture; to allow a sufficient and secure Motion to the Head, Neck, and Body on all necessary Occasions; and to support and defend the Viscera and other soft Parts.

After considering the particular Structure of the Vertebræ, and their mutual Connection, we may observe a solicitous Care has been taken that they cannot be disarticulated, but with great Difficulty: For either their Bodies intersect so into each other, as to prevent their being easily displaced, as in the cervical Vertebræ; as their Bodies are proportioned on all Sides, those of the Back by the Ribs; and their Surfaces of Contact are so broad, and the Ligaments so strong, and firmly connected, as to render the Separation, almost impracticable as in the Loins; while the Depth and Articulation of the oblique Processes are exactly proportioned to the Motion, which the other Parts of the Bones will allow, or the Muscles can perform: Yet as these oblique Processes are small, and therefore not capable of



so secure a Conjunction as the larger Bodies, they may sooner be disarticulated; but this would not be of near so bad Consequence as the Separation of the Bodies: For the oblique Processes being dislocated, the Muscles, Ligaments, and Medulla Spinalis, are extended; but the Medulla Spinalis must be compressed or intirely destroyed, when the Body of the Vertebra is removed out of its Place.

The FALSE VERTEBRÆ compose the inferior Pyramid of the Spine; they are different from those already described by this Epithet of false, because though each Bone resembles the true Vertebrae in Figure, yet none of them contribute to the Motion of the Trunk of the Body, they being intimately united to each other, except at their interior Part, where they are moveable; whence they are commonly divided into two, Os Sacrum and Coccygis.

Os SACRUM is so called from being offered in Sacrifice by the Antients, or rather because of its Largeness, in respect of the other Vertebrae. This Bone is of an irregular triangular Shape, broad above, narrow below, convex behind, for the advantageous Origin of the Muscles that move, the Spine and Thigh posteriorly, and concave before, for enlarging the Cavity of the Pelvis. In young Subjects, it may be easily separated into five Portions; nay, in Adults, some Vestiges\* of this Division are observable on its anterior Surface, and within the great Canal that runs through the middle of it; but on its posterior Sides, there are no such visible Marks of a former Division; however, we can distinguish each of them.

---

\* I have by me one from a Man about forty years of Age, in which these Portions are very distinct.

## 122 The Bones of the Trunk. Lect. vi.

The anterior spongy Part of the Os Sacrum, analogous to the Bodies of the true Vertebrae, is smooth and flat before, to allow a large Space for the contained Viscera.

Its posterior Part is almost strait, as the Vertebrae: The Medulla Spinalis being here small, is separated into a Number of Nerves, called from their Appearance Cauda Equina, which a small Canal can easily contain. The Curvatures, between the Bodies and Processes of this Bone, are much thicker; and, in proportion, shorter than in the other Vertebrae.

The Strength of these transverse Curvatures is very remarkable in the three superior Bones, and is well proportioned to the incumbent Weight of the Body, which they sustain when we are in an erect Posture.

There are only two oblique Processes of the Os Sacrum, one projecting on each Side from its first superior Part. Their plane erect Surfaces are posteriorly, and receive the inferior oblique Processes of the last lumbal Vertebra, to which these Processes are connected by a strong Ligament, which rises from a scabrous Cavity round their Roots, where mucilaginous Glands are also lodged.

The transverse Processes here, are all grown together into one large strong oblong Process on each Side; which answers to the first three Bones, and is very thick, and divided into two irregular Cavities, by a long perpendicular Ridge.

The transverse Processes of the two last Bones of the Os Sacrum are much smaller than the former.

The spinal Processes of the three superior of the Os Sacrum appear short, acute, and almost erect; while the two anterior are open behind, and sometimes a little Knob is to be seen on the fourth,  
though

## Lect. vi. The Bones of the Trunk. 123

though generally it is bifurcated without the two Legs meeting into a Spine.

This Bone is articulated above to the last Vertebra of the Loins, in the same Manner as the lumbal Vertebrae are connected. Laterally, the Os Sacrum is joined to the Os Ilium by Synchondrosis. Frequently these two Bones grow together in old Subjects.

The Use of the Os Sacrum is to sustain the Spine, with all that belongs to it; and likewise contribute to form the Pelvis; its inferior Extremity is turned very far posteriorly, and thereby the inferior Part is much enlarged: This Bone is straiter in female than male Subjects. Lastly, the whole Canal of the Spine, from the first cervical Vertebra to the Extremity of the Os Sacrum, may be looked on as an articulated Elongation of the Cranium, serving to contain a Production of the Brain called the Spinal Marrow; this Canal is larger in the Neck and Loins, than in the Back.

The lateral Foramina formed by the Scissures in each Vertebra transmit the same Number of Nerves.

This Bone in Infants consists of three Pieces connected by Cartilages, as the Vertebrae; the posterior Extremities of the two lateral Pieces being scarce contiguous in any of them.

Os Coccygis, situated at the Extremity of the Os Sacrum, is, in some measure, an Appendix thereof. Its Figure is somewhat like a Cuckoo's Bill, from whence it assumes this Name: The anterior Side is flat, and its posterior a little convex. It is composed of four or five Pieces like false Vertebrae, connected with Cartilages more or less pliable. Sometimes these Pieces are intirely cemented together; in Children, very near the whole of it is Cartilage. The first Piece is the largest, and on each Side of its Basis, there are sometimes small

Apophyses

Apophyses or Coruna, connected closely to the Extremity of the Os Sacrum; it has also sometimes a kind of transverse Apophyses, with small Scissures on their superior Part, which, joining with those in the last Piece in the Os Sacrum, form a Pair of Foramina, situated in the same Order with the other large ones. The other Pieces of the Os Occygis are a kind of irregular Squares, diminishing in Size as they descend, so that the lowest is like a sesamoid Bone. This Bone serves to sustain the Extremity of the Intestium Rectum; and in order to perform this Office more effectually, it is made to turn with a Curve anteriorly, by which also the Bone itself, as well as the Muscles and Teguments, are preserved from any Injury, when we sit with our Body in a reclined Posture.

#### MECHANISM OF THE SPINE \*.

The Articulations of the true Vertebrae of the Spine are plainly double; for their Bodies are joined by Synchondrosis, and their oblique Processes are articulated by the third sort of Ginglymus. Hence it is evident, that their Center of Motion, is altered in different Positions of the Trunk; for when we bow forward, the superior moved Part bears intirely on the Bodies of the Vertebrae; if we bend back, the oblique Processes support the Weight; if we incline to one Side, we rest upon the oblique Processes of that Side, and Part of the Bodies; if we stand erect, all the Bodies and oblique Processes have their Share in our Support. Hence it follows, First, That because the Articulations, of which the Spine is composed, are so numerous; the Medulla Spinalis, Nerves, sanguinous Vessels, &c. are not liable to such

---

\* From MONRO on the Bones, with a little Alteration of the Language, &c. also the greatest Part of this Lecture.

Compression and overstretching in the Motion of the Body, as they would otherwise be, since several Vertebrae must be concerned in every Motion of the Spine; and therefore a very small Curvature is made at the Conjunction of any two Vertebrae. Secondly, That an erect Posture is the surest and firmest, because the Surface of the Contact of the Fulcra is largest, and the Weight is most perpendicular to them. Thirdly, That the Muscles, which move the Spine, act with greater Force in bringing the Trunk to that Posture, than in drawing it to any other: For in bending forward, backwards, or laterally, the Muscles which perform any of these Actions are near the Center of Motion, consequently the Lever with which they act, is shorter than when the Center of Motion is on the Part of the Vertebra, opposite to that where these Muscles are inserted, which is the Case in raising the Trunk. This is extremely well adapted, since, in the Deflections of the Spine, from a perpendicular Bearing, the Weight of the Body soon inclines it which way we design; whereas in raising us erect, this great Weight must be more than counteracted. Fourthly, In calculating the Force exerted by the Muscles, which move the Spine, we should, with BORELLI\* and PARENT,† always make allowance for the Action of the Cartilages between the Vertebrae, which must, in every Motion from an erect Posture, be extended on one Side, and compressed on the other, to both which they will resist; whereas in raising the Trunk, these Cartilages will assist, by their Elasticity. Fifthly, Hence we are led into the Reason of the Phænomenon observed by Mr. WASSE‡. That our Height

---

\* De Motu Animal. † Histoire del'Acad. des Sciences, 1702.  
‡ Philosoph. Transact.

## 126 The Bones of the Trunk. Lect. vi.

is increased in the Morning, and diminished at Night; for the intermediate Cartilages of the Vertebrae being pressed all Day long by the Weight of our Body, become more compact and thin in the Evening; but when they are relieved from this Pressure in the Night, they again expand themselves to their former Thickness; and seeing the Bulk of any Part must vary, according to the different Distention or Repletion of the Vessels composing it, we may understand how we become taller after a plentiful Meal, and decrease after Fastings or Evacuations, which Difference the Abbé FONTENU\* has proved to depend mostly, if not solely, on the different Thickness of these Cartilages. Sixthly, From the different Articulations of the Bodies, oblique Processes of the Vertebrae, and the different Strength of the Ligaments, it is plain they are formed so as to allow a much larger Motion forwards than backwards; this last being of much less Use, might be dangerous, by overstretching the large Blood Vessels that are contiguous to the Bodies of the Vertebrae.

When we are acquainted with the Structure and Articulations of the first and second Vertebrae, and know exactly the Strength and Connection of their Ligaments, there is no Difficulty in understanding the Motions that are performed upon or by the first, though this Subject was formerly Matter of warm Dispute among some of the greatest Anatomists. 'Tis to no Purpose we should enter into a Detail of the Reasons advanced by either Party, but to explain the Fact, as any one may see it, who will remove the Muscles, which, in a recent Subject, hinder the View of these two Articulations, and then will turn the Head into all

---

\* Histoire de l'Acad. des Sciences, 1725.

the different Positions it is capable of. The Head may then be seen to move forwards and backwards on the first Vertebra, as has been already said; while the Atlas performs the Circumgiration upon the second Vertebra, the inferior oblique Processes of the first Vertebra moving easily in a circular way, on the superior oblique Processes of the second; and its Body or anterior Arch having a Rotation on the Odontoid Process, by which the perpendicular Ligament that is sent from the Point of the Odontoid Process to the Occipital Bone, is twisted, while the lateral Ligaments that fix the Processus Dentatus to the Sides of the first Vertebra, and to the Os Occipitis are very differently affected; for the one upon the Side towards the Face, by the Circumgiration, is much shortened and lax, while the opposite one is extended and made tense, and yielding at last no more, prevents the Head from turning any further round on this Axis; so that these lateral Ligaments are the proper Moderators of the Circumgiration of the Head here, which must be larger or smaller, as these Ligaments are stronger or longer, and more or less capable of being extended. Besides the Revolution on this Axis, the first Vertebra can move a small way to each Side, but is prevented from moving anteriorly and posteriorly by its anterior Curvature and transverse Ligament, which are both closely applied to the Odontoid Process.

The anterior Motion here would have been of very bad Consequence, as it would have brought the Beginning of the Medulla Spinalis upon the Point of the Odontoid Process.

The rotatory Motion of the Head is of great Use to us on many Accounts, by allowing us so quietly to apply our Organs of Sense to Objects;  
and

and the Axis of Rotation was altogether proper to be at this Place; for if it had been at a greater Distance from the Head, and the Weight of the Head had at any time been removed from a perpendicular Bearing to the small moveable Articulation, and thereby acquired a long Lever, it would, at every Turn inconsiderately performed, have broken the Ligaments; or they must have been formed much stronger than could have been connected to such small Bones: Neither could this circular Motion be performed on the first Vertebra without Danger, as the Medulla Oblongata adheres so close to these Parts; and likewise the Medulla Spinalis, would have been in Danger of being contorted, and suffering by the Compression this would have made on its tender Fibrils.

It is necessary to observe that the lateral or more moderate Ligaments confine the Motion of the first Vertebra upon the second, that though this Articulation may serve us on several Occasions, yet we are often obliged to turn our Faces farther round than this Joint alone can allow, without the greatest Danger of twisting the Spinal Marrow too much, and also of luxating the oblique Processes; therefore in large Turns of this kind, the Rotation is assisted by all the cervical Vertebrae and Lumbals; and if this is not sufficient, we employ most of the Articulations of the inferior Extremities.

This Combination of a great many Connections towards the Performance of one Motion, is also to be observed, in several other Parts of the Body; notwithstanding such Motions are generally said to be performed by some single Joint only.

#### OBSERVATION.

RUYSCHÉ (Observation LXVII.) says he has met with seven dorsal Vertebrae concerted together, which



which formed an Anchylosis, and curvated into a Circle, so that the Body of the superior Vertebra unites with that of the inferior. The Bodies of four of these Vertebrae scarce formed the Thickness of one.

I have by me, eight dorsal Vertebrae, from an old Subject, ossified together, but not much curvated.

Therefore it is easy to account for the crooked Spine, or hump-backed People as they are commonly called.

Some crooked Spines being so formed in the Womb, by the curved Posture of the Fœtus; at which Time, the Ligaments and Cartilages contract so much as to remain always in that State; others contract by the different Attitude of Pressure, or in Persons, whose Occupation obliges them to remain in the same Posture, or as we observe old Persons, when the Cartilages lose their Elasticity.





## LECTURE VII.

### Of the THORAX.



THE Bones, which form the Thorax, are twelve Dorsal Vertebræ; and commonly twenty four Ribs, viz. twelve on each Side. These Numbers vary sometimes on both; they are distinguished into true and false Ribs: And also a Bone called the Sternum.

The seven superior Ribs on each Side go to the Sternum, and thus form an intire Curvature; for which Reason they are named true Ribs. The five inferior, which do not reach the Sternum, or form intire Arches, are termed false Ribs.

In each Rib, we may consider, in general, its middle Part or Body; two Extremities, one anterior, the other posterior; two Sides one external and convex, the other internal and concave; two Margins, one superior, and the other inferior; and two Labia in each Margin, one external, the other internal.

The posterior Extremity, which may be called the Head of the Rib, is articulated with the Dorsal Vertebræ. At the anterior Extremity, of which fresh Ribs are lengthened by cartilaginous Epiphyses fixed into their osseous Extremities. This Production is termed the Cartilage, or cartilaginous Portion of the Rib.

Each

Each true Rib, at the posterior Extremity, has two small cartilaginous Impressions, distinguished by a kind of Angle, by which they are articulated with the lateral cartilaginous Impressions in the Bodies of the two Dorsal Vertebrae; but the first Rib has but one such Impression, being articulated with one Vertebra only.

At a small Distance from the Head of this Extremity, posteriorly, is another cartilaginous Impression on each Side, a little convex, and closely connected to a small Tuberosity. By these, the Ribs are articulated with the cartilaginous Depressions in the transverse Apophyses of the Dorsal Vertebrae; and the Tuberosities serve for the Insertion of Ligaments. The Portion, which lies between the Head and these Impressions, is contracted, and represents a Cervix.

When the posterior Extremity of a Rib is articulated with two Vertebrae, the second Articulation is always with the transverse Process of the inferior of the two.

Between the Tuberosity and middle Part of the Ribs exteriorly, there is on most of them, a kind of oblique rough Angle of different Breadth. In the first Rib, this Angle is not distinct from the Tuberosity. In the second, it reaches but to a small Distance from it. In the third, this Distance is greater, and thence continues to increase gradually all the Way to the third false Rib; so that if we look directly at the Back of a Skeleton, these Angles seem to represent the two Legs of a pair of Compasses opened pretty wide.

The Ribs interiorly, towards the inferior Margin, have a Scissure reaching from the Angle, all the way to the Extremity, and that chiefly in the five inferior true Ribs, and the first three false ones. The superior Margin of the two first Ribs is acute; the inferior a little rounded. The superior Margin of the third is more obtuse,

and the inferior more flat. In the rest, the superior Margin is somewhat rounded, and the inferior more or less acute.

These Ribs increase in Length as they descend, and their anterior Extremities on each Side are at a greater Distance from one another; so that all the Extremities of one Side, with those of the other, represent on the anterior Part of the Thorax, an Angle almost like that already taken notice of, on the posterior Part. The Extremities of the first Ribs on each Side, do not lie in the same Line with the rest, but being much shorter, are situated farther back; the same Thing is sometimes, though very rarely, observable in the two second Ribs. It is likewise peculiar to the first Rib, that its Breadth increases from the posterior to the anterior Part.

In all the Ribs, the anterior Extremity is lower than the posterior. The first inclines but little, the second more, and the rest as they descend; their anterior Extremities being proportionably at a greater Distance from each other, than the posterior; the Spaces between which are every where nearly the same.

The Ribs are much more curved in the posterior, than in the anterior Part. The Curvature of the two first, on each Side, lies almost in the same Line with the two Extremities of each. This Equality begins to be lost in the third Rib, which is sometimes distorted from the Angle all the way, to the anterior Extremity, the inferior Margin being turned a little externally, and the Curvature superiorly about the middle of it, afterwards inferiorly, and thence to the anterior Extremity. This Distortion increases in the following Ribs, all the way to the third false Rib; all which look like a *Italic S*, and when laid on an even  
Table,

Table, one Extremity is always turned superiorly, the other inferiorly.

The Appendices, Epiphyfes, or cartilaginous Portions of the true Ribs increafe in Length, as they defcend, in the fame Manner as the Ribs themfelves.

Each of them, except the firft, terminates by two cartilaginous Sides, connected by an Angle, by which they are articulated with the Sternum, by a Symphyfis, like that which connects with the other offeous Extremity of the Ribs.

The Cartilages of the firft three or four Ribs, are nearly in the fame Direction with the Ribs themfelves. In the Ribs below thefe, the Cartilages make Angles, at which they turn fuperiorly toward the Sternum, and this Curvature increafes in proportion as the Ribs defcend. The inferior Cartilages, in changing their Direction fuperiorly, lie very clofe to each other, and thofe of the laft two true Ribs, have often at their inferior Margin, a fort of Apophyfis or Production, by which they are connected with the Cartilages immediately below them. The laft two true Ribs extend confiderably in Breadth towards their inferior acute Margins, from the Angle for fome Distance anteriorly. Afterwards they contract in Breadth, and increafe in Thicknefs, forming a fort of Cervix a little longer than that at their pofterior Extremities. In all the Ribs, this Extremity terminates in a Cavity in which the Cartilages are inferted.

The three fuperior falfe Ribs increafe anteriorly in Breadth from the Angle in the fame Manner as already faid. Their Sciffures are moft confiderable. They have Heads, Necks, Tuberoſities, and Angles, almoſt the ſame as in the laft true Ribs. Their Length diminifhes by degrees, and their anterior Extremities ſeparating from each other in the ſame Manner, with thofe of the true Ribs, lie in the ſame Line with them. The laft two have

only one Impression at their posterior Extremities, and are without any Tuberosity.

They are both much shorter than the rest, especially the fifth. All the false Ribs have cartilaginous Appendices. The first is longest and fixed to the Cartilage of the last true Rib. The two following are united at their Extremities. The last two are connected only to Muscles and Ligaments. They are both very short, especially the last, which is not above a Quarter of an Inch in Length. All these Cartilages of the false Ribs are pointed at their Extremities.

The Ribs are articulated anteriorly with the Sternum, and posteriorly with the Vertebrae of the Back. The first Rib is entirely united with the Sternum, by means of its Cartilage. In the Six following, the Extremities of the Cartilages, connect that Bone.

The three superior false Ribs, are connected to each other by the Extremities of their Cartilages; and the first is likewise connected to that of the last true Rib. The two last have no such Connection.

The Connection of the Ribs with the Dorsal Vertebrae is mostly by a Ginglymus. The first Rib on each Side is articulated by its Head, with the lateral Impression in the Body of the first Vertebra, and by its Tuberosity, with the small Cavity in the transverse Apophysis of the same Vertebra.

The second Rib is articulated by its Head with Impressions, in the inferior Part of the Body of the first Vertebra, and superiorly to the Body of the second; and by its Tuberosity, with the articular Cavity, in the transverse Apophysis of the second.

All the other Ribs, except the two last of the false ones, are articulated in the same Manner; that is by their Heads, with the Impressions on the Bodies of two Vertebrae next each other; and  
by

by their Tuberosities, with the transverse Apophysis of the inferior of each two Vertebrae.

The eleventh and twelfth Ribs, are commonly articulated by their Heads only, with the Impression in the Body of one Vertebra.

From what has been said, it is evident, that the ten superior Ribs, are confined to two Motions, one superiorly, the other inferiorly; whereas the two last are left more at Liberty, and are therefore termed floating Ribs.

The Ribs adhere to the Dorsal Vertebrae and Sternum, and form a Cavity capable of Expansion and Contraction, in which are contained chiefly the Organs of Respiration, and those of the Circulation of the Blood. The Mechanism of their Structure shall be spoken of hereafter.

All the Ribs in new-born Infants are complete, only their Cartilages are proportionally longer than in adult Subjects.

#### OF THE STERNUM.

The STERNUM is situated almost perpendicularly on the anterior Part of the Thorax.

It is a long flat Bone not all of the same Breadth.

This Bone is articulated by Synchondrosis to the seven superior Ribs, unless when the first Part coalesces by an intimate Union of Substance and is connected with each of the Clavicles, by a Gingivinus of the second Kind.

It is generally composed of three principal Pieces; the first broad and short; the second longer and narrower, the third a Sort of small Appendix, called by the Greeks Xiphoïdes, from its somewhat Resemblance to the Point of a broad Sword.

The first or superior Portion is broad and thick at the Top, but thinner and narrower below, being nearly of the Figure of a Triangle, with the three

Angles cut off, or of an irregular Square. We distinguish it into two Sides, one external or anterior, the other internal or posterior; four Margins, one superior, two lateral, and one inferior; and four imperfect Angles, two superior, and two inferior.

The anterior or exterior is unequally convex, the posterior or inferior Side, a little concave.

The superior Margin is the thickest, with a large smooth Scissure in the Middle called by the ancients, the Furca. The two superior Angles are two large, thick, articular Scissures, situated obliquely, on each Side of the Furca. The lateral Margins are thin and oblique, and in each of them we see an oblong cartilaginous Mark of the first true Rib. The two inferior Angles are two articular Semi-Scissures, which receive the Cartilage of the second Rib. The inferior Margin is smaller and thicker than the others, being connected by a Symphysis to the second Portion.

The second Portion of the Sternum is much longer than the first. It is flat on both Sides, and broader inferiorly than superiorly. We observe in it sometimes, especially anteriorly, several transverse Lines, which index the Places, where the Parts of which it is composed in Children, are united. Both Sides are flat, but depressed more or less, through the Middle of their whole Length. The superior Margin is small, being proportioned to the inferior one of the first Portion, with which it is connected by a cartilaginous Symphysis. The inferior Margin is still smaller, appearing like a truncated Angle.

The two lateral or greatest Margins have each a cartilaginous Semi-Scissure, and five cartilaginous intire Scissures. The Semi-Scissures are superiorly of the lateral Margins where they meet the Semi-Scissures in the first Piece.

The



The five intire Sciffures come nearer to each other in Proportion as they are lower, and the last Part often belongs to the third Portion.

The third commonly called *Cartilago Xiphoïdes*, or *Enfiformis*, is entirely cartilaginous in young Subjects; but in advanced Age it generally ossifies, either wholly or partly; in some Subjects later than in others: it would therefore be more properly named *Appendix Xiphoïdes* or *Enfiformis*.

This Portion is articulated to the inferior Extremity of the second, between the Cartilages of the last true Ribs; and is often more or less sciffured on each Side, to form Part of the last articular Sciffures of the Sternum. But neither its Figure nor Size are constant. In some Subjects, it is forked, in others perforated. Sometimes it is very large, sometimes very small, hardly exceeding the third Part of an Inch.

From different Directions of Ossification of the *Enfiformis*, arise sometimes great many Inconveniences: Particularly, when the inferior Extremity is intirely indurated and turned internally, or the Conjunction with the Sternum too loose.

ROLFINCIUS \* relates, that an old Man, who could not bend his Body anteriorly, without a violent pungent Pain from the Ossification of the acute Apex of the † *Xiphoïdes*. PAAW, says, that he has seen Instances of a Difficulty of Breathing, from the same Ossification of the *Enfiformis*, he enumerates several Diseases that may arise from it, such as *Phthisis*, *Pulmonalis*, *Obstructions* of the Spleen, Liver, or Mesentery, which is caused by the internal Curvation of the *Enfiformis*.

The interior Substance of the Sternum, is almost cellulous and very slender, and covered externally, with a thin compact *Lamellæ*.

It completes the anterior Part of the Cavity of the Thorax; and sustains the anterior Extre-


---

\* Dissert. Anatom.

† De ossibus.

mities of the Ribs; being sufficiently fixed to resist Compressions, and other external Accidents; and yet moveable enough, by Means of its Articulation, with the Cartilages of the Ribs, not to obstruct the Motions necessary for Respiration. It likewise serves for the Insertion of several Muscles, and to support the Mediastinum, &c. as also to defend the vital Organs, Heart, and Lungs, anteriorly; and, lastly, as a moveable Fulcrum to the Ribs, in Respiration.

### OF THE CLAVICULÆ.

The CLAVICULÆ \* and the SCAPULÆ are generally comprehended by Anatomists as Parts of the superior Extremities; but they appear to me, more properly to belong to the Trunk. They are situated transversely, and somewhat obliquely in the superior and anterior Part of the Thorax, between the Apophysis of the Scapula and the Sternum. It is long and incurvated in the Form of a Roman  placed horizontally; convex before next to the Sternum, and concave towards the Acromium. This Bone is straiter in female than male subjects. It is divided into a Body or middle Portion, and two Extremities, one anterior, inferior, and internal, which I term the pectoral or sternal Extremity; the other posterior, superior and external, which WINSLOW named the humeral or scapular Extremity.

The pectoral Extremity is the thickest, and of a triangular Figure, especially near the End, where it is a little enlarged, and shews a cartilaginous Surface, with three Angles †, of which the

---

\* So called from Clavis; being the Figure of a Key, among the Romans.

† Sometimes the superior Angles of this Surface are wanting.

lowest is the most prominent, and turned a little toward the Cavity of the Thorax.

Near these Angles, there are several muscular ligamentary Impressions; one of which, near the inferior Angle, is sometimes raised like a Tubercle.

The humeral Extremity is flat and broad, and two Sides may be considered in it; one superior, the other inferior; likewise two Margins, one anterior, the other posterior; and a small articular Surface.

The superior Side has several Inequalities, and in the inferior, there is a Kind of oblong rough oblique Tuberosity. The posterior Margin is convex, thick, and uneven, being that of the small Curvature of the Clavicula. The anterior Margin is concave, narrow, and smooth, every where, except near the great Curvature, where it has a rough Impression. The articular Surface terminates this Extremity, being cartilaginous, turned obliquely forward, and of an oval Figure, like that of the Acromium, with which it is articulated. The Substance of this Bone is the same as other cylindrical long ones. It is articulated with the Acromium and Sternum, by Arthrodia, or what MONRO calls the second Species of Ginglymus.

The Articulation with the Scapula by Means of the Acromium, is as real and distinct as the Articulation with the Sternum; which last appears something extraordinary in the Skeleton, where the small Scissure in the Sternum is no ways proportioned to the broad Extremity of the Clavicula.

The Claviculæ of Infants are not deficient in any of their Parts, nor have they any Epiphyses at their Extremities, as most other such long Bones have, which preserves them from being inflected

inflected too much, and from the Danger of any unossified Parts being separated by the Force which pulls the Arms anteriorly.

The Claviculæ serve for Buttresses to the Scapula, and limit their Motions anteriorly and superiorly; by their ligamentary Connections, they likewise hinder the Scapulæ, from running too much posteriorly; which might happen in those who drag Burdens behind them, &c. They also give Insertion to many Muscles.

### OF THE SCAPULA.

The SCAPULA, called also Omoplata, is a large Bone of a triangular Figure, situated laterally at the superior and posterior Part of the Thorax, from about the first Rib down to the seventh.

It may be divided into two Sides, one external or posterior and convex; the other internal or anterior and concave; three Margins, the one named the Basis, and two named Costæ, one superior, the other inferior; three Angles, one anterior, called the Head or Neck, one superior and one inferior. I shall begin with the Margins and end with the Sides.

The Basis is the longest Margin of the Scapula. It is commonly situated on one Side of the Spine, a little obliquely, the superior Part of it being nearer the Vertebrae, than the inferior. It is, as it were, divided into two Parts, by a very obtuse Angle, which distinguishes the superior Quarter from the three other Quarters. It is considerably thick, and is accordingly divided into two Labia, one exterior, the other interior. It continues to be an Epiphysis in many adult Subjects, towards both its Extremities, especially towards the inferior.

The superior Costa is the shortest and thinnest of the three Margins. It is situated almost transversely between the superior Point of the Basis and Cervix of the Scapula, being a little more raised toward the Basis, than at the other End, where it often terminates by a small Scissure. It is divided into an internal and external Labium.

The inferior Costa is of a middle Length, between the other two Margins. Its Situation is very oblique, between the inferior Point of the Basis and Cervix of the Scapula. It is thicker than the rest, and often appears to be double, having two very distinct Labia, the exterior of which is thin, the other round. These two Labia are separated by a Kind of Canal or Sulcus; and upon the external Labium, is a narrow Impression which runs from the Cervix, through two thirds of the Length of the Costa.

The Cervix of the Scapula, is the biggest of the three Angles. It ought more properly to be called a Head with a very short Neck; and a superficial or glenoid Cavity, in the Top of it, which is lined with a Cartilage, and of an oval Figure, but pointed at the superior Part, and rounded at the inferior; and deeper in the natural State, than in the Skeleton. In the natural Situation of the Scapula, this Cavity is turned obliquely forward, and not directly exteriorly. Between the Margin of this Cavity, and the contracted Part, which is the true Cervix, some Inequalities are observable, which are the Remains of Ossification of the Symphysis.

At the superior Part of the Cervix, there is a Production or Epiphysis, resembling a crooked Finger or Crow's Bill, called the Coracoid Apophysis or Epiphysis, which, at its Origin, has a Tuberosity, for the Insertion of the Ligaments of the Clavicle. It terminates by three muscular

lar Impressions, which altogether form an obtuse Point.

The Angles next the Basis have nothing very remarkable, only that the superior is more acute than the inferior in some Subjects.

The exterior Side of this Bone is unequally convex, and a little below the superior Costa, shews a long, high, thin Eminence, called the Spine of the Scapula, which rises gradually higher from the Curvature, or obtuse Angle, at the Basis, all the Way to the Cervix, and afterward turns superiorly and anteriorly over the coracoid Apophysis, forming another broad Apophysis, called the Acromium. The Name of Crista is given to the Margin of this Spine.

This Crista is extended in Breadth, in three particular Places. The first is near the Basis of the Scapula, where there is a smooth triangular Surface. The second is a kind of oblong, flat, and rough Tuberosity. The third is at the Acromium, already mentioned. On the anterior Margin of this Apophysis, near its Point, is a small cartilaginous Apophysis for the Articulation of the Scapula with the Clavicula.

The Body of the Spine divides the external Side of the Scapula in two Portions; the superior is least, and termed *Fossa supra Spinalis*; the inferior and largest, *Fossa sub Spinalis*; in which we observe a long Depression lying a little above the Costa Inferior; and running from the inferior Angle, we likewise meet with a Kind of small distinct Surface unequally triangular and oblong, which ascends on the inferior Costa, towards the Sinus in its external Labium.

The interior Side of the Scapula is irregularly concave, chiefly superiorly, and in a Manner divided into several superficial and longitudinal *Fossulae*, by little Ridges, which run like  
Radii

Radii from the Cervix toward the Basis. The Direction of these Lines is transverse, with respect to that of the Ribs.

Besides these Parts, we observe likewise three Scissures, one very large between the Cervix and the Spine, one small, between the superior Costa and the coracoïd Apophysis, and one of a middle Size, between that Apophysis and the glenoïd Cavity. There is sometimes a particular Foramen, which either perforates the Basis of the Spine at its Middle, or is there lost in the Substance of the Bone.

Here are two small rough Marks, which are muscular Impressions of the Cervix of the Scapula, immediately above, and below the glenoïd Cavity; the inferior of which extends itself a little over the adjacent Costa.

In the Cervix, Spine, Basis, inferior Costa, and coracoïd Process, there is a Diploë; the rest of the Bone is thin, transparent, and almost without any intervenient cellulous Substance.

The Scapula is articulated with the Clavicular and the Acromium, with the Humerus, by the glenoïd Cavity. It is likewise connected to the Trunk by Syssacrosis.

The Basis, Acromium, coracoïd Process, and Head of the Scapula are all in a cartilaginous State at the Birth, and the three first are articulated as Epiphyses; while the Head, with the glenoïd Cavity, is not formed into a distinct separate Bone, but is gradually produced by the Ossification of the Body of this Bone, being continued anteriorly.

The Use of the Scapula is to serve as a Fulcrum to the Arm; and by altering its Position, on different Occasions, to allow always the Head of the Humerus a right situated glenoïd Cavity to move in, and thereby to assist and to enlarge  
greatly

greatly the Motions of the superior Extremity, and to afford the Muscles, which rise from it, more advantageous Actions, by altering their Directions, to the Bone which they are to move.

This Bone also serves to defend the posterior Part of the Thorax, and is often employed to sustain Weights, or to resist Forces too great for the Arm to bear.

### OF THE PELVIS.

The PELVIS consists of three Bones, viz. two *Ossa innominata*, and the *Os sacrum*, which last is already described.

The *Ossa innominata* (so improperly named,) have always retained three distinct Names, as being three separate Bones in Infants; connected by a Cartilage, which afterwards perfectly ossifies, having commonly no Vestige of the first Division.

Anatomists, however, consider it, even in Adults, as three different Portions, and distinguish them by different Names, as if they were three distinct Bones.

Of these three, the largest is the superior, posterior, called *Os Ilium*; the second, inferior, *Os Ischium*; the third and smallest anterior *Os Pubis*.

Before we treat of each of these Portions separately, it must be observed, that in the intire Bone, there are several common Parts, which belong to more Portions than one, viz. a deep cartilaginous *Cotyloid*, or *Acetabulum*, formed by these three Portions: a large Opening, called *Foramen Ovale*, which, from its Resemblance to a Shield, has been also named *Thyroïdes*, formed by the *Ossa Ischii*, and *Pubis*: a larger posterior Scissure or *Sinus*, called the *Ischiatic Scissure*



or Sinus, formed by the Os Ilium and Os Ischium: an oblique Eminence or Protuberance above the Acetabulum, toward the Foramen Ovale, made by the Offa Ilium and Pubis.

To these may be added a Ridge on the Inside of the Pelvis, which divides the superior Part from the inferior, to which alone the Ancients gave the Name of Pelvis.

### OF THE OSSA ILII.

The Os ILIUM was so named by the Ancients, because it supports the Parts called by them Iliia.

This Bone is the largest of the three. It is flat, very broad, unequally convex and concave, partly round, and partly of an irregular square Figure.

It is divided into the Crista, Basis, anterior and posterior Margins, and two Sides, one external, the other internal.

The Crista is the superior Part, being a pretty thick arched Margin; the Circumference of which is a little more than the Quadrant of a Circle. The anterior and middle Parts are externally convex, the posterior a little convex interiorly. We observe in it two Labia, and a middle Space, or Interstice between them. It is originally an Epiphysis, the Marks of which are sometimes very conspicuous even in advanced Age.

The posterior Portion of the Crista, which is interiorly convex, is much thicker than the anterior, and for that Reason might be called the Tuberculum of the Crista. The whole Crista appears to be crufted over with a Cartilage, which in Reality is no more than the dried tendinous Insertions of the Muscles.

The anterior Margin of the Os Ilium, has two Eminences or Tubercles, called the anterior Spines; one superior, the other inferior; and likewise two

Sciffures, one between the Spines, the other below the inferior Spine.

The posterior Margin is shorter and thicker than the anterior. It terminates likewise in two Eminences or Spines, between which there is a considerable Sciffure.

The Basis, or inferior Part, of this Bone is the thickest and narrowest of all. It forms anteriorly a Portion of the Acetabulum, and posteriorly almost all the Ischiatic Sciffure.

The exterior Side is convex anteriorly, and concave posteriorly. We observe on it the Remains of a long semicircular Line, which reaches from the superior anterior Spine, to the great Ischiatic Sinus, being a muscular Impression. Above and behind this Semicircle, there are several other Marks and muscular Impressions. A little above the Margin of the Acetabulum, we see likewise many Inequalities, which surround Part of that Margin in a semicircular Form, being a Collection of muscular and ligamentary Marks.

The interior Side is unequally concave, and has several Inequalities toward the posterior Part, the chief of which is, that large cartilaginous Surface, of the Figure of an S, or of a Bird's Head, which answers to the lateral Surface of the Os Sacrum, with which it is connected by a cartilaginous Symphysis.

The other Inequalities are much of the same Kind with those in the lateral Part of the Os Sacrum, with which they form several rough and irregular Cavities. From the superior Part of the cartilaginous Surface or Symphysis, all the Way to the oblique Eminence, runs a prominent Line, which bounds the Cavity of the Inside of this Bone, and distinguishes the Margin of the Pelvis from its inferior Portion.

## OF THE OSSA ISCHII.

The Os ISCHIUM is the inferior Portion of the Os Innominatum, as well as of the whole Trunk. It is divided into Body, Tuberosity, and Ramus or Branch.

The Body of the Ischium forms the inferior and greatest Portion of the Acetabulum, and sends out an Apophysis posteriorly, called the Spine of the Ischium.

The Tuberosity is very thick, unequal, and turned inferiorly; and it is on this Part that the whole Body rests, when we sit. It appears cartilaginous, because of the dried and hardened remains of the Tendons. The whole convex Portion of it is originally an Epiphysis, of which the Marks are obliterated sooner, in some Subjects, than in others.

The Branch of the Ischium is a Kind of small, flat, thin Production, or Apophysis, which ascends anteriorly from the Curvature of the Tuberosity to the Pubis; and is often covered in Part by a Continuation of the Epiphyses of its Tuberosity.

These three Parts of the Ischium, taken together, form a large Opening, which makes the greatest Part of the Foramen Ovale. Three other Scissures are remarkable upon this Bone; one posterior, between the Tuberosity and the Spine, for the Passage of the internal Obturator Muscle, which is somewhat cartilaginous, and divided into three or four small superficial Canals; one lateral, between the Tuberosity and the Acetabulum, for the Passage of the external Obturator Muscle; and one anterior at the Margin of the Acetabulum for Ligaments, &c.

## OF THE OSSA PUBIS AND ACETABULUM.

The Os PUBIS is the least of the three Portions of the Os Innominatum. The two together form the anterior Part of the Pelvis; and in each we may distinguish the Body, Angle, and Branch.

The Body of the Os Pubis is superiorly situated transversely before the inferior Part of the Os Ilium. Its posterior Extremity is very thick; and by the Union with the Ilium, forms the oblique Eminence, which distinguishes these two Portions of the Ossa Innominata. It likewise contributes to the Formation of the Cotyloid Cavity. Its anterior Extremity terminates in a small Eminence or Tuberosity, called the Spine of the Os Pubis, which is sometimes double.

The superior Margin has interiorly an oblique Ridge; which may be called the Crista of the Os Pubis, and is continuous with that Ridge which distinguishes the Margin from the inferior Part of the Pelvis. Before this Crista, is a broad, oblong, and oblique Slope. The inferior Margin is obliquely scissured, and forms the superior Part of the Foramen Ovale.

The Angle of the Os Pubis anteriorly makes that Connection; called the Symphysis of the Ossa Pubis. This Portion is flat and not very thick; and, in some Subjects, toward the superior Part of the anterior Side, near the angular Curvature, it has an Eminence which increases the Size and Extent of the Spine already mentioned. The two Ossa Pubis, connected by this Portion, form anteriorly an unequal Convexity; but posteriorly a pretty even Cavity.

The Branch of the Os Pubis is a flat thin Apophysis, which, descending, unites with the Branch of the Ischium by a cartilaginous Symphysis,

physis, of which only some Vestiges remain in Adults. It completes the Formation of the Foramen Ovale. The Branches of the two Ossæ Pubis form, anteriorly, a pointed Arch; which, in the natural State, is much rounder.

Besides what has been said of the Acetabulum in general, there are other Particulars to be observed, which could not well be mentioned till after the Description of the three Portions, of which it is composed. These are the Margin called Supercilium, the cartilaginous Cavity, the Impression at the inferior Part of it, and the Scissure in the Margin.

The Margin, or Supercilium, is very prominent superiorly; on the Sides this Prominence decreases as it descends, and between the anterior and inferior Part, is quite lost. In the natural State it is increased by an additional elastic Circle, which shall be described.

The Cavity is proportionable to the Prominence of the Margin, and consequently deeper on the superior and posterior, than on the inferior and anterior Part. It is covered with a very smooth Cartilage except from the Middle to the Scissure.

This Portion of the Cavity, which is without Cartilage, is what WINSLOW calls the unequal Impression, which is broader toward the inferior Cavity, than toward the Margin, and serves to contain a Ligament and a Fasciculus of Glands.

The Scissure is exactly between the anterior and inferior Portion of the Margin of the Cavity, near the Foramen Ovale, which in a Manner, unites with it. The Situation of this Scissure is oblique, with respect to the Direction of the whole Body in an erect Posture.

The Substance of all the three Portions is mostly spongy, except in the Middle of the Os Ilium,

where the two Tables uniting, renders the Bone transparent ; and the same is to be said of the Acetabulum.

The *Ossa Innominata* are connected to the *Os Sacrum*, and to each other by a cartilaginous *Symphysis*. They are articulated with the *Os Femoris* by *Enarthrosis*, as we shall see in describing that Bone.

The *Ossa Innominata*, together with the *Os Sacrum*, form the *Pelvis*, which is Part of the Cavity of the Abdomen, and supports several *Viscera*, especially those which are the common *Receptacles* of the *Urine* and gross *Excrements*, and those by which the two *Sexes* are distinguished.

The *Pelvis* is larger in *Women* than in *Men*; the *Ossa Ilium* and *Ischium* are wider. The *Curvature*, formed by the *Branches* of the *Ossa Pubis*, is likewise greater in *Females*. In an *Infant* the great thick Part of this Bone is in a cartilaginous State ; and the spinous Process, great *Tuberosity*, and recurved Branch are all in the same Condition.

Moreover these Bones, together with the *Os Sacrum*, support the whole *Trunk*, and all the Parts belonging to it, and also the inferior *Extremities*. In a Word, they are the *Basis* of the whole *Body*, and the general *Center* of all its *Motions*, when standing, sitting, or lying.



## LECTURE VIII.

### The CARTILAGES and LIGAMENTS of the TRUNK.

**T**HE CARTILAGES of the Vertebrae in general are of two Kinds; one proper to each, and the other common to the two that lie next each other. The first I term Cartilages of Articulation, the others Cartilages of Symphysis.

The proper articular Cartilages of each Vertebra of the whole Spine, are those Four which cover the Surfaces of the four small articular Apophyses. Their Circumference is the same with that of the articulated Surfaces of the Apophyses, except in those Places where there are small superficial Scissures.

In the first cervical and lumbal Vertebrae, those Cartilages are thicker than in the rest.

The two inferior articular Cartilages of the first Vertebra, and the two superior of the second, seem, in fresh Bones, to be somewhat disproportionate, though not so much as in dry Bones; and in some Subjects, we find moveable or inter-articular Cartilages, between the Apophyses of these two Vertebrae.

The first cervical Vertebra has a small cartilaginous Incrustation in the Middle of the concave Side of its anterior Curvature, answering to another on the anterior Side of the Odontoid Apophysis of the second; so that these two

Vertebræ, have five articular Cartilages each, besides the inter-articular ones already mentioned.

The dorsal Vertebrae, besides the four Cartilages of their small Apophyses, have others which do not belong to their Articulations with one another, viz. those which cover the lateral Fossulae in the Bodies of these Vertebrae and the Fossulae of their transverse Apophyses, by both which they are articulated with the Ribs.

The Cartilages of Symphysis lie between the Bodies of the Vertebrae, one of them being contained between, and closely joined to the inferior Surface of the Body of one Vertebra, and to the superior Surface of that next under the former; the Breadth and Circumference of them answering exactly to that of the Surfaces, to which they are connected; but their Height or Thickness is different in each Class of the Vertebrae. In the Lumbal, they are a quarter or third Part of an Inch in Thickness, according to the Stature of the Subject.

The Cartilages in the cervical Vertebrae are not so thick, and the thinnest of all are the Dorsals.

These Cartilages are not of an equal Thickness in all their Parts; the Cervical and Lumbal appear to be thickest anteriorly, and the Dorsals rather thickest posteriorly; but these Differences are most remarkable in the Vertebrae, that lie near the Middle of each Class.

The internal Structure of these Cartilages is different from that of all the other of the Body; and indeed they resemble the rest in nothing but in Whiteness and Elasticity.

When we view their Circumferences only, they seem to be one uniform Mass as the others generally are; but when they are joined, we see that they are composed of a great Number of cartilaginous concentric Circles contained within each other,



other; and a small Space left between them. They are closest and thinnest near the Centre, and about the Middle seem to degenerate into another softer kind of Substance.

These Circles do not form an intire Circumference, being turned interiorly and posteriorly, answerable to the posterior Scissure in the Body of each Vertebra.

They lie horizontally, one Margin being fixed to the inferior Side of one Vertebra, and the other to the superior of the next below the former. The Interstices between the Circles, are filled with a mucilaginous Substance, less fluid than that of the Joints; and their Breadth and Height is proportionable to the Distance of the Vertebrae between which they lie.

Each cartilaginous Lamina, taken separately, is very pliable according to its Length, but taken all together; they are not so easily bent, partly because of their circular Figure, and partly because of their Proximity and Multiplicity.

They yield, however, in the Inflexions of the Spine; and their external Surface (which in the ordinary Situation of the Spine is even with the Surface of the Vertebrae) becomes prominent, or projects on that Side toward which the Inflexion is made, the Cartilages being then compressed by the Vertebrae.

They likewise yield on all Sides, without any Inflexion of the Spine to the Weight of the Head and superior Extremities; but this is done by very small and imperceptible Degrees, and most of all, when the superior Parts of the Body are loaded with any exterior Weight.

They restore themselves afterwards merely by being freed from Compression; so that a Man is really taller after lying some time, than after he has walked or carried a Burden for a great while; the

the most natural and simple Reason that can be given for the different Heights of the same Person, at different times, first observed in England, and afterwards confirmed by M. MORAND\*, being the different State of the inter-vertebral Cartilages.

The inter-vertebral Cartilages of the Neck lying, for the most part, between the convex Side of one Vertebra, and the concave of another, are of a greater Extent in Proportion to the Size of these Vertebrae, than the Dorsal and Lumbal.

Without this Convexity and Concavity in these Vertebrae, (which are the least of all) the Cartilages could not have been large enough to be able to resist Strains and great Motions.

The Os Sacrum has no Cartilage, except that between the superior Side of the first false Vertebra, and the last Lumbal, and those by which it is connected with the Offa Innominata.

The inter-vertebral Cartilages of this Bone in an Adult, are too much obliterated to need a Description.

The Cartilages which connect the different Portions of the Os Coccygis are preserved in some Subjects, to a very great Age; in others they soon intirely ossify.

#### LIGAMENTS OF THE SPINE.

The Vertebrae are strongly connected to each other by three Kinds of Ligaments; each Vertebra is connected to that above and below it, by a great Number of others, very short and strong, which cross each other obliquely, and are fixed round the Margins of the Body of each Vertebra.

---

\* A Member of the Royal Academy of Sciences of Paris.

These crucial Ligaments cover the Circumference of the inter-vertebral Cartilages, and adhere closely to them.

They seem to be looser in the cervical and lumbal Vertebrae, than in the Dorsals, and by that means yield to the Cartilages in the different Inflexions of the Spine already mentioned.

The Bodies of all the Vertebrae, from the second Cervical to the Os Sacrum, are covered by ligamentary Semi-vaginæ on the Convexity, in which these Vaginæ are fixed, surrounding all the crucial Ligaments, and composed of ligamentary Fasciculi and Filaments, partly oblique, but mostly longitudinal.

All the Vertebrae are likewise strongly connected by a ligamentary Tube, which lines the interior Surface of the medullary Canal from the occipital Foramen, to the Os Sacrum, at the superior Part, being equal to that of the occipital Foramen, and terminating in a small Pivot at the Os Sacrum.

This Ligament is composed of several Strata of longitudinal and oblique Fibres, interwoven together, and adhering closely to the Inside of the great Foramen, in each Vertebra, by a great Number of Filaments detached from it to the porous Substance of the Vertebrae.

The first Vertebra is not only fixed to the Os Occipitis, by a Portion of this ligamentary Tube, but also by a distinct and very strong ligamentary Integument, which surrounds and adheres very compactly to the tubical Part.

This Covering is fixed above, round the great occipital Foramen, where it begins to adhere to the Tube, and below, quite round the Circumference of the first Vertebra.

The second Vertebra has two Ligaments peculiar to it, one which connects the Apophysis Densiformis

tiformis to the Os Occipitis ; and another transverse, which confines this Apophysis within the anterior Portion of the Cavity of the first Vertebra. The first may be termed the Occipital, and the second the transversal Ligament of the Odontoid Apophysis.

The occipital Ligament is very strong and thick, and adheres in a very singular Manner to the three Planes of the Apex of the Apophysis, and is afterwards divided into two or three Portions which are fixed in the like manner, in the anterior Margin of the great occipital Foramen, and in the Inequalities of the Apophsis Basilaris near that Aperture.

The transversal Ligament may be properly said to belong to the first Vertebra, both Ends of it being inserted in the lateral Impressions of their Surface of that Vertebra mentioned in the Description of the Skeleton. But it is ranked among the Ligaments of the second Vertebra, because of its Use, and the Insertion of its middle Portion.

This thick Ligament is stretched from one Side of the interior Surface of the first Vertebra, to the second.

About the Middle of the anterior Side, its Texture is very compact, and it is fixed by this Portion posteriorly to the Apophysis Dentiformis, and sometimes it seems to have additional Fasciculi ; which adhere by one End to both Extremities, and by the other, to each Side of the Apophysis.

Along the whole osseous Canal of the Spine, between the Bases of each spinal Apophysis, lies a flat and very elastic Ligament of a yellowish Colour, which fills up the posterior great Scissures of the Vertebrae, adhering to their Margins ; and likewise to the adjacent Portions of the great ligamentary Tube.

Between

Between the Extremities or Apices of the spinal Apophysis, we find small ligamentary Ropes, which go from one Spine to another; and which are really double, though they seem to be single in the Dorsal and Lumbal. In the cervical Vertebrae, they are fixed separately to the forked Extremities of the Spines.

Between all the spinal Apophyses, from their Apices, to the Middle of the Bases, lies a ligamentary Membrane passing between each two Apophysis, and thereby distinguishing the right Side of the Vertebrae from the left. There is a Ligament of the same kind between the transverse Apophysis.

These are inter-muscular Ligaments, or ligamentary Septa, which divide the Muscles of one Side from those of the other, as was already observed in speaking of the Ligaments in general, and will appear more particularly in the Description of the Muscles. The first Kind are termed Inter-spinales, the other Inter-transversales.

The articular Ligaments of the Spina Dorsi, are those which tie the glenoid Cavities of the first Vertebra, to the Condyles of the Os Occipitis; those that join the cartilaginous Surface of the Apophysis Dentiformis, to the anterior Cavity of the first Vertebra; and those by which all the oblique or articular Apophyses are connected.

These are all small, short, strong ligamentary Fasciculi, fixed by both Extremities, round the cartilaginous Surfaces of the Apophyses, surrounding very closely all the capsular Ligaments of these Articulations.

The vertebral Ligaments of the Ribs, or those which connect the Ribs to the Bodies and transverse Apophyses of the dorsal Vertebrae, are of the same kind; being inserted round the cartilaginous

nous Fossulæ, in the Body and Apophysis of each Vertebra.

Besides all these Ligaments of the Spina Dorſi, there is one which goes in the Form of a Membrane, from the Os Occipitis, all the way to the last two cervical Vertebrae.

It is broad at the superior Part, and from thence diminishes gradually. By its superior broad Extremity, it is fixed along the occipital Spine, and by one Margin, in the posterior Tubercle of the first Vertebra, between the two spinal Furcæ of the following Vertebrae, and in the Apices of the spinal Apophyses of the inferior Vertebra; but the other Margin is loose. This is a true inter-muscular Ligament; and WINSLOW names it, Ligamentum Cervicale Posterius.

There are two lateral Ligaments of the same kind fixed to the transversal Apophyses of the cervical Vertebrae, which shall be described together with the Muscles.

#### CARTILAGES OF THE STERNUM AND RIBS.

The STERNUM of an Adult has commonly sixteen Cartilages, fourteen of which are articular, the other two Symphyses. Of the articular Cartilages, two belong to the Articulations of the Clavicula, and twelve to those of the true Ribs, from the second to the seventh inclusively. The two Symphyses are those between the Sternum, and the first Rib on each Side.

There is likewise another Symphysis, by which the superior Portion of the Sternum is connected to the inferior, the Cartilage of which is obliterated in advanced Age.

The Apophysis Ensisformis is often ossæous toward the Sternum, and more or less cartilaginous at the other End.

In

In very aged Persons it has been found intirely ossified ; and sometimes wholly cartilaginous, even in Adults.

#### LIGAMENTS OF THE STERNUM AND RIBS.

The STERNUM has several Ligaments, by which it is connected with the Clavicles and Ribs. It is articulated to the Clavicles, by strong short Ligaments, fixed by one Extremity round the Margins of its two superior Scissures ; by the other, in the Extremity of each Clavicle, and by the Middle, to the inter-articular Cartilages already explained, surrounding the particular Ligaments which go between the Margins of these Cartilages and the Sternum ; and the capsular Ligaments between them and the Clavicles.

All the Ribs are connected to the Bodies of the Vertebrae, by strong, short, ligamentary Fasciculi, fixed by one End round the Fossulae in the Vertebrae, and by the other round the Head of each Rib.

The Ribs are likewise tied to each other, by thin Ligaments which go obliquely from the Cartilages of each Rib, to that of the next.

All the Ribs have cartilaginous Portions, which differ from each other in Length, Breadth, Incurvation, Adhesions, and in their Extremities ; all which were explained in the Description of the Skeleton.

The ten superior Ribs on each Side are connected to the transverse Apophyses of the dorsal Vertebrae, by strong, short, articular Ligaments fixed to the Tuberosities of the Ribs, and round the Fossulae of the Apophysis, much in the same manner with those which go between the Heads of the Ribs and Bodies of the Vertebrae. Both  
these

these Articulations are provided with capsular Ligaments.

The eleventh Rib, on each Side, having no Articulation with the transverse Apophyses, is connected to them by auxiliary, strong, short Ligaments fixed in its Cervical.

The last Rib is only connected by its Head to the Body of the twelfth dorsal Vertebra ; but it is connected in a particular manner to the transverse Apophysis of the first lumbal Vertebra, by a broad Ligament fixed in the whole superior Margin of the Apophysis, and in the inferior Margin of the Rib, through about Two-thirds of its Length.

The first true Rib has no ligamentary Connection with the Sternum, the cartilaginous Symphysis being sufficient. The rest are closely joined to that Bone, by small ligamentary Portions fixed by one Termination round the Extremity of the Cartilage, and by the other, round the Scissure in the Sternum. On the superior and inferior Sides of each Articulation, these Ligaments are very short, but anteriorly they are expanded over the Sternum in a radiated manner.

The Cartilage of the first false Rib, is joined to that of the last true Rib, by several short Filaments, which go from the inferior Margin of the one, to the superior Margin of the other, near its small Extremity.

The other false Ribs are connected together much in the same manner, with this Difference only, that the Filaments by which the fourth Rib is connected to the third, are longer than those above them ; and those between the fifth Rib and the fourth, much longer than any of the rest : and for this Reason, those two Ribs are less steady than the others.



THE PERIOSTEUM, MARROW, AND MUCILAGINOUS GLANDS OF THE VERTEBRÆ, STERNUM, AND RIBS.

The ligamentary Expansions of the Vertebrae are in lieu of a Periosteum, both externally and internally. The Sternum and the osseous Portions of the Ribs have a Periosteum like the other Bones. The cartilaginous Portions of the Ribs are covered by a Membrane of the same Kind, termed Perichondrium. As the internal Structure of the Bones is cellulous or spongy, they contain only small separate Portions of Marrow, or a red medullary Juice that is in the Vertebrae.

The mucilaginous Glands of all these Articulations are very small, but accompanied by many fatty Moleculæ lying round each Joint. The interior Surface of the ligamentary Tube, which lines the osseous Canal of the Spine, is lubricated by an oleaginous Substance, which shall be taken notice of in the Description of the Brain.

THE CARTILAGES OF THE OSSA INNOMINATA.

They are not so numerous as one might imagine, on examining the Skeleton only. We are apt to think we see the dried Remains of Cartilages on the Crista of the Os Ilium, on the Tuberosity of the Os Ischium, and on the Sinuosity and Scissures which give Passage to the Tendons. But none of these Incrustations are true Cartilages, being, for the most part, tendinous, aponeurotic, or ligamentary, which, being dried, look more like Cartilages, than the true Cartilages themselves.

The Crust which covers the Crista of the Os Ilium is chiefly tendinous, and a small Part of it

aponeurotic in Adults ; but in Children and Persons advanced in Years, it appears cartilaginous. In Children, the Parts which are not completely ossified, are easily taken for true Cartilages ; and in old Age, the Tendons are often hardened to so great a Degree, as to have the very same Appearance. The Substance which covers the Tuberosity of the Ischium, is almost tendinous, and that which lines the Sinuosities and Scissures of the Tendons is chiefly ligamentary.

The true Cartilages of the *Ossa Innominata*, in adult Subjects, are five ; three common, and two proper.

The first and principal common Cartilage, is that which makes the Symphysis of the *Ossa Pubis*. It reaches from the internal between the Spines of these two Bones, all the way to the Angle formed by the two Rami, where it begins to separate. It is something thicker or broader superiorly, for a considerable Space, than inferiorly ; but this Part is much the broadest. It fills the Angle already mentioned, and forms a kind of Curvature, which is more considerable in Women than in Men.

The two other common Cartilages join the *Ossa Ilium*, to the *Os Sacrum*, but are thinner than that of the *Ossa Pubis*.

The proper Cartilages are those that line the cotyloid Cavities. Concerning these, we have already observed in the Description of the Skeleton, that in the Margin of each, there is a Scissure or Opening between the anterior and inferior Parts ; and that in the Cavity itself, there is a broad unequal shallow Depression, reaching from the Scissure, beyond the Middle of the Cavity. All the rest of the Surface of the *Acetabulum* is covered with a very white, shining, smooth Cartilage ;  
which

which terminates precisely at the Margin of the Cavity.

The Circumference of the Acetabulum has besides a Margin of a particular kind; the Substance of which is neither wholly cartilaginous nor ligamentary, and will be described among the Ligaments.

#### LIGAMENTS OF THE OSSA INNOMINATA.

These LIGAMENTS are of two Kinds, Common and Proper. The common are those which go between these and the adjacent Bones, of which there is a considerable Number, viz.

One superior Ligament inserted by an Extremity in the internal Labium, posteriorly to the Crista of the Os Ilium, about an Inch above the Angle of that Crista. It is about an Inch in Breadth, and is fixed by its other Extremity in the whole inferior Margin of the transverse Apophysis of the last lumbal Vertebra.

One inferior and anterior, fixed by one End interiorly to the Angle of the Crista of the Os Ilium, and by the other superiorly and anteriorly to the first false transverse Apophysis of the Os Sacrum. In this Ligament there are transverse Openings which make it appear more or less complex.

Several inferior and posterior are fixed by one End along the internal Labium of the Tuberosity of the Crista of the Os Ilium, and by the other in the first three false Apophyses, over the Marks of the false oblique Apophyses of the Os Sacrum.

To these must be added the Ligaments by which the Os Femoris is connected to the Os Innominatum, which shall be described among the other Ligaments of the Thigh.

The principal proper Ligaments are four in Number; two called Sacro-Sciatic, one broad and external, the other small and internal, one obturator, and one inguinal.

The broad sacro-sciatic, or internal sciatic Ligament is slightly fixed interiorly to the Tuberosity of the Crista of the Os Ilium, covers exteriorly the two posterior Spines of that Bone, and continues to be inserted along the anterior and exterior Margins of the false transverse Apophyses of the Os Sacrum. Thence this Ligament diminishing in Breadth, descends obliquely towards the Tuberosity of the Ischium, and is immediately inserted below the Sinus, which lies between that Tuberosity and the sciatic Spine. This Insertion is afterwards continued over the whole internal Labium of the inferior Portion of the Ramus of the contiguous Os Pubis.

Through all the lateral Course of its Insertion, that is, after its Arrival at the Tuberosity of the Ischium, it produces a Kind of ligamentary Falx, one Edge of which is fixed in the Bones, the other lies loose; and by this Situation of the Falx, it forms, together with the Bones, a kind of deep Canal or Sinus.

The small sacro-sciatic or internal sciatic Ligament adheres very close interiorly to the posterior Portion of the former. It is fixed interiorly to the Margin of the inferior Part of the fourth false transverse Apophysis of the Os Sacrum, and thence all the way superiorly to the Os Coccygis.

From this Insertion, it ascends a little obliquely to the Spine of the Ischium, to which it is fixed in the acute Apex and superior Part, during this Course, transverfes the broad Ligament, being closely united to the Inside thereof, losing but very little of its Breadth.

By

By these two Ligaments, two distinct Apertures are formed, a large one with the superior sciatic Sinus, and a small one, with the inferior sciatic Scissure.

The obturatory Ligament fills up all the great Foramen Ovale, except the oblique Scissure at its superior Part. It is fixed exactly to the Margin of the Circumference of that Aperture, from the anterior Part of the oblique Scissure, all the way to the Symphysis between the Os Pubis and the Os Ischium; thence posteriorly to the inferior Scissure. It is fixed to the internal Labium of the Margin of the Circumference, forming a kind of small Canal with the external Labium; and afterwards to the common Margin of the Foramen Ovale, and cotyloid Scissure or Opening.

By this Disposition, an Aperture is left between this Ligament, and the superior oblique Scissure; and immediately below this common Aperture, there are two small Perforations in the Ligament itself.

On the inside of the superior and interior Part of the Os Pubis, there is a transverse Ligament fixed superiorly to it from the oblique Scissure of the Foramen Ovale, all the way to the inferior Part of the Symphysis, at a small Distance from the Circumference of the last mentioned Aperture.

This transverse Ligament is about half an Inch in Breadth in an Adult, and posteriorly below the superior oblique Scissure of the Foramen Ovale, it connects the obturatory Ligament, by means of a particular Plica; and by parting from it afterwards, a kind of deep narrow Sinus is formed between them; the transverse Ligament being there supported by ligamentary Fræna of different Sizes.

The inguinal Ligament, called from the Discoverer, *Ligamentum Fallopii*, is only an aponeurotic or ligamentary Membrane, fixed by one Extremity to the anterior and superior Spine of the *Os Ilium*, and by the other to the Spine of the *Os Pubis*. The middle Portion of it is very narrow, but it expands considerably toward both Extremities. It is closely connected to the abdominal Muscles, and to the aponeurotic Fascia of the Thigh. It seems to be often wanting, as shall be observed in the Description of the Muscles.

Besides these Ligaments peculiar to each *Os Innominatum*, there is another small, flat, and very strong Ligament, which runs transversely between the two Angles of the cotyloid Scissure, and may be reckoned among the Ligaments. It is a sort of additional Piece, strongly united to the Margin of that Cavity, but easily yields both ways to any Pressure. It may be stretched out by pulling, and recovers and contracts again, when that Force is removed. It is of a very singular Texture, being composed of elastic Fibres, interwoven together through its whole Circumference, and which, in several Places are by degrees inclined toward the osseous Margin of the Cavity.

It makes an intire Circle, and where it passes over the Scissure, the transverse Ligament, before mentioned, serves to support it, as the osseous Margin of the Cavity does through all the rest of its Circumference.

Though I have referred the Description of the two Ligaments, by which the *Os Femoris* is connected to the *Os Innominatum*, to another Place, their Insertions in the last named Bone must nevertheless be mentioned here. One of these Ligaments surrounds the whole Articulation, the other is contained therein. The first is called the Orbicular

cular Ligament, the other, very improperly, the round Ligament.

The orbicular Ligament is very strong and unequally thick. It surrounds the whole convex Circumference of the Supercilium of the cotyloid Cavity is to which it is strongly fixed, for the Breadth of near a Quarter of an Inch, from the acute Margin externally, and thence seems to send off a ligamentary Aponeurosis which shall be explained in the Myography.

Its Insertion at the sharp Margin of the cotyloid Cavity is connected to that of the elastic Border; the rest of the Ligament is distinct from the Border, and only touches it quite round, and where it passes over the Scissure, is fixed in the transverse Ligament.

The Ligament which lies in the Joint is not round, as its Name imports. It is a flat Cord, broad at one Extremity, and narrow at the other; and therefore, in some measure, of a triangular Shape. By its narrow Margin, it is inserted at the two Angles in the Scissure of the cotyloid Cavity, and by the other in the Os Femoris, as shall be described. This broad Extremity may be reckoned the Basis of the Ligament; and thence arise some distinct ligamentary Filaments, which are inserted at different Distances, in the Circumference of the rough Impression of the cotyloid Cavity.

#### MEMBRANES, MUCILAGINOUS GLANDS, AND MARROW OF THE OSSA INNOMINATA.

There is nothing in the Periosteum of these Bones different from what has been said above, except what relates to the Insertion of several Muscles; but that cannot be explained till these Muscles are described.

The rough unequal Depression, at the Bottom of the cotyloid Cavity, is filled by a broad, flat, mucilaginous Gland, bordered with an offeous Substance, and covered by a fine Membrane, through which a mucilaginous Liquor passes, to moisten the Joint and facilitate its Motions.

This Membrane rises above the Gland, and gives a sort of Covering to the Ligament contained in the Articulation. The sanguinous Vessels of this Gland pass between the Bottom of the cotyloid Sinus, and the transverse Ligament thereof.

As these Bones have no internal Cavity, and their Substance being cellulous or cavernous, they contain no medullary Mass.

The Cellulæ of their cavernous Substance contain a medullary Juice, which distils incessantly through the Membrane with which they are all lined.

The sanguiferous Vessels pass chiefly through the small Apertures, in the convex and concave Surfaces of these Bones; and ramifying upon the offeous Cells, terminate in a great Number of minute Tubuli, which make the medullary Juice appear reddish.

#### OBSERVATION.

Though the Curvature of the Spine, which I am going to describe, is different from a Gibbosity, yet still it has some Affinity to it. A labouring Woman, who used to carry heavy Baskets of Sand on her Back, there was no apparent Deformity; the winding Flexures of the Vertebrae so corresponding with each other, as to hide it; till, in dissecting her, when I came to examine the abdominal Viscera, I found the Aorta displaced very much to the left Side, and upon laying the Bones of the Thorax quite bare, found the two superior dorsal Vertebrae retained their natural Situation. The third inclined to one Side in such a Manner, that its



its Middle was turned towards the left, but the whole taken together, pointed towards the left, in its superior Part, and in its inferior towards the right. In the fourth and fifth, these Circumstances were more observable; but in the sixth the Distortion was much more obvious, so that the Body of it was wholly turned to the right Side, and nothing appeared on the anterior Part, but the lateral Portion, which is nearest to the Articulation with the Ribs. The seventh was distorted in the like Manner, except that the inferior Extremity inclined it again to the left. Below this, the whole Spine was turned towards the left, and at the same time the right Side of the Bodies of the Vertebrae projected anteriorly.

Lastly, In the anterior Part of the eleventh and twelfth dorsal Vertebrae, a preternatural Tuberosity appeared, formed by an Anchylosis of the two contiguous Vertebrae, and copiously pouring out from the Sides of their Bodies an ossifying Fluid, which concreting into a very hard and smooth Tubercle, united them in that Part; the last and remaining of the inter-vertebral Ligament still retaining its cartilaginous Tenacity. On the left Side of the Bodies of the first and second lumbar Vertebrae, it had a remarkable Cavity. Vid. LONGHANS in HAL-  
LER's Pathological Observations.

I have a Skeleton of a Lad whom I dissected about two Years ago, in which the four inferior dorsal Vertebrae were so curvated anteriorly, and by Anchylosis, that the fourth inferior dorsal Vertebra almost reached the superior Part of the first Lumbar. All the Bodies of the twelve Dorsals were carious anteriorly. The Vena Cava was lacerated at the Curvature of the Vertebrae, which was the Cause of his sudden Death. The Subject was born crooked, and his Bones are very white and light, which inclines me to think that the Disease was in the ossifying Fluid,



## LECTURE IX.

### The SUPERIOR EXTREMITIES.



THE superior Extremity is commonly divided by Anatomists, into Scapula, Clavicula, which compose the Shoulder, Arm, Fore-arm, and Hand. The Arm consists of one single Bone called *Os Humeri*, and the Fore-arm consists of two, the one called *Cubitus* or *Ulna*, and the other *Radius*.

The Hand is composed of the *Carpus* or Wrist, the *Metacarpus*, and the Fingers.

As to the *Scapula* and *Clavicula*, I thought proper to range them among the Bones of the Trunk already described. For if these Bones belong to the superior Extremities, in like manner must the *Ossa Innominata* be described in the Division of the inferior Extremities; which has not been done by any Author I know of, under that Denomination. For as the *Scapula* receives nothing more than the Head of the *Os Humeri*, so the *Ossa Innominata* receive only the Heads of the *Ossa Femorum*.

#### OF THE *OS HUMERI* OR *BRACHIUM*.

The *Humerus*, or Bone of the Arm, is both longer and thicker than any other Bone of the superior

## Lect. ix. Superior Extremities. 171

perior Extremity; it is situated under the Acromium laterally to the Thorax, from which, however, it may be removed to a considerable Distance in all Directions. Its Figure is irregularly cylindrical, thick at one Extremity, and broad at the other.

It is divided into the Body and two Extremities; or into a superior, middle, and inferior Part.

The superior Part is generally called the Caput of the Os Humeri, and that Part immediately below, the Cervix.

In the Caput we consider a Semi-globus obliquely inclined, crufted over with a smooth Cartilage: Two Tuberosities, one large, terminating superiorly in a Point, opposite to the Semi-globus: A Canal between the two Tuberosities: Four muscular Impressions, three of which are on the large Tuberosity, viz. one in the Apex, one on the Side opposite to the Sinus, the third lower down on the same Side, opposite to the small Tuberosity, upon which the fourth is found. Of these four Impressions, that on the small Tuberosity, and the second of the other three, are the largest. All these Parts of the Caput of the Humerus are one Epiphysis in Children, of which very visible Marks remain sometimes in advanced Age.

The Canal, or Sinus, between the two Tuberosities, is continued inferiorly in an oblique Direction through one Quarter of the Length of the Bone, and there becoming rough, forms a muscular Impression not always equally sensible. The Margin of this Sinus, are two Ridges, or prominent Lines, continued down, as it were, from the Tuberosities. That from the great Tuberosity, being the most considerable, is continued down to the middle of the Bone, where it is lost in a long, broad, raised, muscular Impression, more or less rough. The other, which comes from the  
small

small Tuberosity, is less prominent and shorter. At the Side of this Ridge, toward the inferior Part, are two other narrow, longitudinal, and superficial muscular Marks one above the other; the inferior Extremity of the first reaching down to the anterior of the superior Extremity of the second.

The middle Part, or Body of the Humerus, comes nearer to a cylindrical Figure than the Extremities. It is a little raised at the rough Eminence, or Impression, already mentioned. On each Side of this Eminence, is another muscular Impression, which, uniting immediately below it, appears to be inclosed between them, as between the two Prongs of a Fork. On that Side which answers to the middle of the Semi-globus, we see likewise a longitudinal muscular Mark, and about the Middle of that Side, which is even with the great Tuberosity, there is an oblique concave Turning, of a considerable Length and Breadth, which, descending by the Side of the forked Impression, makes this Part of the Bone appear contorted.

This inferior Extremity of the Humerus is triangular from its very Beginning, and thence grows flat, being bent a little near the Extremity, towards that Side which answers to the small Tuberosity in the superior Extremity. It is divided into three Sides, two anterior, and one posterior, which is the broadest; and into three Angles, one anterior, and two lateral. At the End of this broad Extremity, are two Tuberosities, one short and prominent, answering directly to the Middle of the Semi-globus; the other oblong, rough, and resembling a Crista, which answers to the Apex of the great Tuberosity of the Head. The short Tuberosity is called the Internal Condyle, the other the External.

Between

Between these two Condyles, on the lower Part of the concave Side of this Extremity, are two articular Extremities, one double like a Pulley next the short Condyle, the other rounded like a small Head next the long Condyle.

The Trochlea has a great and small Margin with a Depression between them; the small Margin is lost in the round Eminence or Head; the great one is gradually widened, and ends in a sharp Circumference. This Trochlea is situated obliquely; for on the concave Side, it approaches toward the short Condyle, and on the other, it is turned from it. Three Fossulæ are likewise observable in this inferior Part of the Bone; two anterior, one immediately above the Trochlea, the other above the small Head; and one posterior, which is very large, and situated likewise immediately above the Pulley. In Children, the Pulley, the small Head, and the short Condyle, are Epiphyfes.

The external Substance of this Bone is complete, especially in the Middle, within which there is a large tubular Cavity, containing a reticular Texture of osseous Filaments. The external Sides of the Extremities are less solid, and their internal Substance is cellular.

The particular Situation of this Bone deserves to be well considered; because we are often misled in forming an Idea of it, by viewing the Bone itself, separated from the Trunk by the Figures which have been given of it, and by the undue Application of the Terms, external, internal, anterior, and posterior, to the different Parts thereof; which Mistakes may be of very bad Consequence in many chirurgical Cases.

When we examine the Os Humeri as lying along either Side of the Trunk, in its natural Situation, the Head will be found so disposed, as that the Semi-globus is turned interiorly and posteriorly, answering

swering to the Situation of the glenoid Cavity of the Scapula; the great Tuberosity, externally and anteriorly; the Canal between the two Tuberosities, almost directly forward; the long Condyle, said commonly to be external, is turned as much anteriorly as exteriorly; and the short Condyle, the Internal turned as much posteriorly as interiorly.

This Bone is articulated above with the glenoid Cavity of the Scapula, by Enarthrodia; and below, with the two Bones of the Fore-arm, in the Manner hereafter described.

Both the Extremities of this Bone are cartilaginous in a new-born Infant, and the large Head, with the Tubercles, and the Trochlea, with the two Condyles, become Epiphyses, before they are united to the Body of the Bone.

#### OF THE ULNA, OR CUBITUS\*.

The ULNA, so termed from the Use of it by the Ancients, is irregularly triangular, diminishing in Thickness from one End to the other. It may be divided into the Body, or middle Part, and two Extremities, one great, the other small.

In the great Extremity, we observe two Eminences; one large, called Olecranon, or Ancon; the other small, called Corone, or the Coronoid Apophysis; and two Semilunar, or Sigmoid Cavities, one great, the other small.

The Olecranon is a large Apophysis ending in a rough Tuberosity, and an obtuse Point. The Tuberosity makes the Corner of the Elbow; the Point is lodged in the posterior Cavity of the inferior Extremity of the Os Humeri, when the Fore-arm is extended. Next, under the Tubero-

---

\* *Fecile majus, canna, vel arando, major & inferior Brachii.*

sity, is a flatish, oblong, triangular Surface; external to which, is another of the same kind, but longer and a little concave, together with a muscular Fossula.

The coronoid Apophysis is prominent and a little pointed, resembling a broad short Beak. It is received into the anterior Cavity above the Trochlea, at the inferior Extremity of the Humerus when the Fore-arm is bent.

The great sigmoid Cavity lies directly between these two Eminences, reaching from the Apex of one, to the other. It is articular, covered with a smooth Cartilage, and divided through its whole Length, by a middle angular Line; being thus suited exactly to the Pulley of the Humerus, upon which it moves obliquely, these two together making a most perfect Ginglymus, as well in respect of their Structure, as of their Use. The half Cavities, on each Side of the angular Line, are also divided transversely by another Line, a little concave, which terminates at the middle of each Margin, of the Cavity by a very small Scissure.

The small sigmoid Cavity, which may likewise be termed transverse or lateral, is a sort of transverse Scissure, in the inferior Portion of one Margin of the great sigmoid Cavity, at the Side of the coronoid Point, directly opposite to the muscular Fossula, already mentioned. It is covered with a Cartilage, as well as the great one, of which it appears to be a true Continuation, and it belongs to the Articulation of the Radius.

Near this Cavity, directly under the coronoid Apophysis, there is a very muscular Impression sometimes raised like a Tuberosity.

This superior Extremity is oblique, and its Obliquity answers to that of the Trochlea of the Humerus.

The small Extremity is cylindrical, of a less Diameter than any other Part of the Bone ; it may be reckoned a kind of Cervix, ending in an inverted Head, flat at Top, and of a cylindrical Circumference, both which are covered with the same smooth Cartilage, and the Circumference is broader on the Side of the coronoid Apophysis and small sigmoid Cavity, than any where else. From the Head, descends a short styloid Apophysis on the Side of the Tuberosity of the Olecranon, distinguished from the rest of the Circumference by a small Scissure.

The middle Portion, or Body, of the Ulna is divided into three Sides and three Angles. One of the Sides is narrow and rounded, one broad and concave, and the third flat, and marked with an oblique Line on its superior Part. The narrow Side answers to the Tuberosity of the Olecranon, and is covered only by the common Integuments.

The other two Sides are distinguished from the former by two blunt Angles ; and they unite at a sharp Angle, which lies opposite to the rounded Side, and answers to the Point of the coronoid Apophysis. The concave Side is even with the small sigmoid Cavity, and the flat Side opposite to it. These two Sides give Insertion to many Muscles, and the sharp Angle to what is called the Interosseous Ligament. At the Apex of this Angle, there is a narrow, oblong, muscular Impression. The Angle, common to the rounded and flat Sides, terminates inferiorly, in an oblong, uneven, muscular Eminence.

The Substance of the Ulna is much the same with that of the Humerus, already described.

The



## Lect. ix. Superior Extremities. 177

The Tuberosity of the Olecranon, and the small inferior Head, with its styloid Apophysis, remain for a long time Epiphyses, in some Subjects.

It is connected with the Trochlea of the Os Humeri by an angular Ginglymus; with the two Extremities of the Radius, by a compound lateral Ginglymus; and with the Hand by Ligament, and not by Articulation.

The Situation of this Bone may be considered two Ways; either when the Fore-arm is extended, and lies along the Side of the Trunk, or when it is bent, and lies on the inferior Part of the Breast. The first Situation appears to be most commodious for determining what Parts of the Bone are to be called Anterior, Posterior, Superior, Inferior, External, and Internal. But the second seems most natural, as being the most common in living Bodies, whether sitting or standing, and has accordingly been followed by some of the Ancients. I shall have Occasion to say something more upon this Head, in describing the Radius and Bones of the Hand.

### OF THE RADIUS\*.

The RADIUS is nearly of the same Length with the Ulna, bigger at one End than the other, irregularly triangular, a little bent, and situated along the Side of the Ulna; its Name is taken from the Resemblance it was thought by the Ancients to bear to the Spoke of a Wheel.

We are to consider in this Bone two Extremities and a middle Portion. One Extremity is small, and like a kind of Head set upon a Neck; the other is large, - resembling a Pedestal or Basis;

---

\* *Focile minus; canna minor, arundo minor.*

## 178 Superior Extremities. Lect. ix.

and therefore it might be divided into a Head, Body, and Basis.

The Head, or small Extremity of the Radius is very short or low, the Top of it is concave, and the Circumference cylindrical; and both the glenoid Cavity and Circumference are covered with the same smooth, shining, cartilaginous Crust; and about one Quarter of the Circumference is broader than the rest.

The Cervix is small, and its Situation a little oblique. It ends by a lateral Tuberosity, which lies directly under the broad Part of the Head, being rough on the Middle, and on one Side, and smooth and superficially cartilaginous on the other.

The Basis, or great Extremity of the Radius, is much broader than it is thick, and has two broad Sides, and one narrow. One of the broad Sides is a little concave, and pretty even; the other is unequally convex, and divided by longitudinal Eminences, or osseous Lines, into three or four longitudinal Canals, much more distinct in fresh Bones, than in the Skeleton.

The narrow Side is concave longitudinally, and between it and the other two, two Angles are formed; by which the three Sides are distinguished; and opposite to it, the other two meet in a third Angle. This narrow Side ends in a femilunar Cavity, bordered with a smooth Cartilage, and lying almost in the same Direction with the Tuberosity. The broad Sides end at their common Angle, by an obtuse Point or Production, which has been called the styloid Apophysis of the Radius, and is really a Continuation of one of the osseous Lines already mentioned.

The whole Basis ends in an oblong triangular glenoid Cavity, the Cartilage of which is continued over the concave Margin of the narrow Side. This is an articular Cavity, resembling an Arch, and  
ending

## Lect. ix. Superior Extremities. 179

ending on one Side at the styloid Apophysis, and concave on the other, by the Cavity of the narrow Side. It appears divided into two Portions; by a small transverse Line, and in the natural State, the concave Side is lengthened out by a cartilaginous Production.

The Middle, or the Body of the Radius is a little incurvated, the Concavity lying between the Tuberosity in the Head, and semi-lunar Cavity in the Basis. It has three Sides; one rounded, which is the convex Side of the Curvature, and two concave: Three Angles, two of which are obtuse, distinguishing the two concave Sides from the convex; and the third acute, lying between the two concave Sides opposite to the convex Side. In each of the Sides there are several muscular impressions.

The Substance of this Bone is like that of the Ulna; the Head and Basis are Epiphyses in Children, and in some Subjects remain such for a long time afterward.

The Radius is connected with the Ulna, Os Humeri, and Carpus. It is articulated with the Ulna at its two Extremities, by a double lateral Ginglymus; the cartilaginous Circumference of the Head, turning in the small sigmoid Cavity; and the semi-lunar Cavity, in the Basis, turning upon the small Head, at the inferior Extremity of the other Bone; and thus the small Extremity of one Bone is joined to the great Extremity of the other.

It is articulated with the Humerus, by the Application of the Cavity in the Top of its Head to the small Head, at the inferior Extremity of the other Bone.

By this Conformation, it would be capable of moving in all Directions, but as it is tied to the Ulna at both Extremities, its Motions on the

## 180 Superior Extremities. Lect. ix.

small condyloid Head, at the inferior Extremity of the Humerus, are confined to two Kinds ; that of Rotation, when it turns on the Sides of the Extremities of the Ulna ; and that of Flexion and Extension, in common with the Ulna ; and both these Motions may be performed at the same time.

The Articulation of the Radius, with the Bones of the Carpus, shall be explained in describing these Bones.

### OF THE BONES OF THE HAND ; AND FIRST, THE BONES OF THE CARPUS.

The HAND is the last Part of the superior Extremity, and is divided into the Carpus, Metacarpus, and Fingers, as has been already said in the Enumeration of the Bones of the Skeleton. It may be further divided into the concave and the convex Side. The concave Side is likewise called the Inside, because it is commonly, and (as it were) naturally turned toward the Body, and so hid. The convex Side is for the same Reason, named the External, as being for the most part turned exteriorly, and exposed to View. The first is also named the Hollow or Palm of the Hand ; the other the Back of the Hand.

The Carpus or Wrist consists of eight small unequal and irregular Bones ; and taken all together, they represent a sort of Grotto of an irregular quadrangular Figure, and connected principally with the Basis of the Radius. Considered in this manner, the whole Collection of them, has two Sides, and four Margins. One of the Sides is convex and external, the other concave and internal. The Convexity of the external Side is pretty uniform, but the inner or concave Side has four Eminences, one at each Corner. One of the four  
Margins

Margins touches the Fore-arm ; and is as it were the Head of the Carpus ; another Margin may be termed the Basis, and touches the Metacarpus ; the third is toward the Apex of the Radius ; and the fourth toward the Point of the Ulna. The first of these last I shall call the small Margin, the other the great.

The Bones of the Carpus, are divided into two Rows ; the first of which lies next the Fore-arm ; the second next the Metacarpus. Each Row consists of four Bones, but the fourth of the first Row lies in a manner out of its Rank ; each Bone has several cartilaginous Surfaces, for their mutual Articulations ; and in some of them, for their Articulations, with the Radius, and Bones of the Metacarpus and Thumb.

It is to no Purpose to distinguish the three ordinary Dimensions in any of these Bones, except one ; but in most of them, we may consider six Sides, one external, turned toward the convex Surface of the Carpus ; one internal toward the concave Surface ; one towards the Fore-arm, which Dr. WINSLOW called the brachial Side ; one toward the Fingers, the digital Side ; one toward the Point of the Radius, or the radial Side ; and one towards the Point of the Ulna, or the cubital Side.

Of these Sides some are osseous, others cartilaginous or articular. These last we shall call Sides ; the other Surfaces, as being Portions of the common Surface of the Carpus in its natural Situation.

To distinguish these eight Bones from each other ; they are called first, second, third, and fourth Bones of the first or second Row, beginning to count from the Radius or Thumb.

LYSERUS has been at great pains to give a particular Name to each of them. He calls the first Bone of the first Row *Os Scaphoïdes*, or *Naviculare*; the second *Os Lunare*; the third *Os Cuneiforme*; the fourth *Os Pisiforme*; the first Bone of the second Row *Os Trapezium*; the second *Os Trapezoïdes*; the third *Os Magnum*; and the fourth *Os Unciforme*.

The first Bone of the first Row is termed *Scaphoïdes* in Greek, and *Naviculare* in Latin, from its Resemblance to a small Boat. Next the Radius it has a convex Side, by which it is articulated, with the Basis of that Bone, and a Tubercle, which is one of the four Eminences, on the concave Side of the Carpus. Toward the Thumb it has two half Sides; one large, for the *Os Trapezium*, another small one for the *Os Trapezoïdes*. It has likewise a concave Side for the *Os Magnum*, and a small semilunar Side for the *Os Lunare*. The interior and anterior Surfaces are rough.

The second Bone of the first Row is called *Lunare*, because one of its Sides is in Form of a Crescent. The articular Sides in this Bone, are four in Number; one convex for the Basis of the Radius; one semi-lunar for the *Os Scaphoïdes*; one almost triangular, for the *Os Cuneiforme*; and one hollow, which, with the concave Side of the *Scaphoïdes*, forms an oblong Convexity, answering to the oblong Concavity in the Basis of the Radius. The exterior and interior Surfaces are small and rough. This Bone would be better named *Os Semi-lunare*.

The third Bone of the first Row called *Cuneiforme*, from its Figure, appears rather like a Wedge sticking between the two Rows. It has a rough Surface, with a small Tubercle upon it, which forms the greatest Part of the cubital Edge

of the Carpus, and four articular Sides; whereof one is convex, which completes the articular Convexity of the Carpus; one orbicular and internal, or on the concave Side of the Carpus, on which the Os Pisiforme is set, and two which make an Angle between them; one for the Os Semi-lunare, and the other for the Os Unciforme.

The fourth Bone of the first Row called Orbiculare, Pisiforme, and Lenticulare, from its Figure and Size, is irregularly round. It has but one cartilaginous Side irregularly orbicular, the Border or Circumference of which represents a sort of narrow Collar. The rest of the Bone, is rough, convex, and irregularly round; making one of the four Eminences on the concave Side of the Carpus. This Bone and the Os Cuneiforme may be supposed to make a third Row, distinct from the other two.

The four Bones of the second Row lie all in a Line; the first being articulated with the Thumb, the rest with the Metacarpus.

The first Bone of the second Row is named Trapezium, or Os Cubiforme, Trapezoïdes, as being supposed to be of an unequal square Figure. Its exterior Surface is rough, and makes a Portion of the convex Side of the Carpus. On its interior Surface, is an oblong Eminence, which makes one of the four Eminences on the same Side it has a Sinus.

There is likewise a small Tubercle, on the exterior Surface.

It has several articular cartilaginous Sides, viz. one brachial, one digital, and two cubital.

The brachial Side, which is concave, is articulated with the Os Scaphoïdes; the digital, with the first Phalanx of the Thumb; one of the cubital Sides, with the Os Trapezoïdes; and the other with the first Metacarpal Bone.

The Side which is articulated with the first Phalanx of the Thumb, appears to be made up of two superficial sigmoid or semilunar Half-sides, distinguished by an Eminence of the same Figure, being each more concave toward the Sides, than at the Middle, which makes a Portion of a sort of superficial Trochlea, with the Margin much worn.

One of the cubital Sides, which is articulated with the Os Trapezoïdes, is large; the other, which connects the first metacarpal Bone, is small.

The second Bone of the second Row deserves the Name of Pyramidale, rather than Trapezoïdes, being a kind of Pyramid, with the Point broke off. Its Basis makes a Portion of the exterior or convex Side of the Carpus, and its Point a Part of the concave Side.

It has several articular Sides, viz. one brachial, which is the least of all, and articulated with the Os Scaphoïdes; one digital, of a considerable Length, scissured on each Side, and divided into two Halves, by a sort of middle Line or Angle, which gives it the Appearance of a Trochlea, articulated with the Basis of the first metacarpal Bone; one radial, irregularly triangular, and articulated with the Os Trapezium; and one cubital, a little concave, and articulated with the Os Magnum.

The third Bone of the second Row, called Os Magnum, Maximum, or Capitatum, so named, being the largest of all the carpal Bones, is of a considerable Length, and has a kind of articular round Head, which is received into the cotyloid Cavity, formed by the two first Bones of the first Row; and this Articulation is capable of a small degree of Flexion and Extension.

The digital Side is a cartilaginous Basis, unequally and obliquely triangular; the Apex being turned



## Lect. IX Superior Extremities. 185

turned internally. It is articulated with the second metacarpal Bone, and is also a little scissured on the radial Margin, for its Articulation with the small Margin of the first metacarpal Bone.

The radial Side is very small and near the Basis, being articulated with the Os Pyramidale; the rest of this Surface is without Cartilage. The cubital Side is double, answering to a like Side in the Os Unciforme with which it is articulated.

The exterior Surface, which forms a Portion of the concave Side of the Carpus, is broad, rough, and uneven, for the Insertion of Ligaments. The interior Surface is likewise rough, but narrower, and round both Surfaces are several Depressions, which in the natural State, are filled with small Glands, Ligaments, &c.

In the fourth Bone of the second Row, we are to consider the Body, and hooked or unciforme Apophysis, from whence it has the Name of Unciforme.

This Apophysis, one of the four Eminences, on the carpal concave Side, is flat, and the concave Side of its Curvature, turned toward the Os Magnum.

The exterior Surface of its Body is rough, and in some measure triangular. It completes the convex Side of the Carpus, and toward the Ulna terminates in a small Tuberosity, which is all the cubital Side of this Bone.

It has three articular or cartilaginous Sides, one radial, one brachial, and one digital.

The radial Side is double, answering to the cubital Side of the Os Magnum. The brachial Side is very oblique, some part of it being a little concave, the rest a little convex; answering to the digital Side of the Os Cuneiforme. The digital Side is double, or distinguished into two Parts,  
by

by a sigmoid angular Line, for its Articulation with the two last Bones of the Metacarpus.

The Bones of the Carpus are articulated with each other by Arthrodia; but the first Row forms a sort of Ginglymus with the second, because the Head of the Os Magnum may turn in the cotyloid Cavity of the first Row, while the two first Bones of the second Row slide upon the digital Side of the Os Scaphoides; and the Os Unciforme in the same manner, on the Os Cuneiforme.

When all these Bones are in their natural Situation, a transverse Depression is formed on the convex Side of the Carpus, by which the two Rows are distinguished. This Depression appears most between the Os Scaphoides and the three last Bones of the second Row, and looks like a kind of Fold, by which the second Row is thrown back upon the first.

The four Eminences on the concave Side of the Carpus, are for the Insertion of a strong transverse Ligament. The interior Substance of all these Bones is spongy, and their Surfaces are not very compact.

#### OSSA METACARPI, OR THE METACARPAL BONES.

The Metacarpus is the second Part of the Hand, situated between the Carpus and the Fingers. The Antients, who called the Carpus, Brachiale, from whence the Word Bracelet seems to be derived, termed the Metacarpus, Post Brachiale.

The Metacarpus consists of four Bones, one Side of which forms a broad Cavity, called the Palm of the Hand; the other a gentle Convexity, called the Back of the Hand. The antient Anatomists

## Lect. XI. Superior Extremities. 187

tomists reckoned five Bones in the Metacarpus, including that Bone, which is now looked upon, as the first Phalanx of the Thumb.

The Bones of the Metacarpus, are long thicker at the Extremities, than in the Middle, and of unequal Length and Bigness. The first is the largest, the rest are lessened by Degrees in all their Dimensions. The two first are sometimes, though very rarely, equal.

Each Bone is divided into the Extremities and middle Part ; or into a Basis, Body, and Head. The Bases are angular, and turned toward the Carpus ; the Heads, rounded like Condyles, and turned toward the Fingers. Both are covered with Cartilages, and the Heads remain for a long Time very distinct Epiphyses.

The Bases are narrow and almost angular, toward the Palm of the Hand ; toward the Back of the Hand, their Breadth is considerable, but on the other two Sides, they are very broad ; and there they have small articular Sides, which I call lateral Sides. The Heads are flatted on the two Sides, which answer to the lateral Sides of the Basis, and their greatest Convexity is turned toward the Palm of the Hand, terminating in two obtuse Points.

Several Scissures and Fossulæ, break in upon the lateral Sides ; and the flat Sides of the Heads are a little depressed ; a small Tubercle arising in the Middle of each Depression.

The Body of each Bone is contracted, of a triangular Figure, and distinguished into three Sides, whereof one is external and a little convex, contributing to make the Back of the Hand ; the other two internal, and a little concave, one being turned obliquely toward the Radius, the other toward the Ulna. These three Sides are separated by the same Number of Angles, and that

that Angle which parts the two internal Sides is sharp. It is by these two Sides, and the Angle between them, that the Hollow of the Palm of the Hand is formed.

OS METACARPI INDICIS, or the FIRST METACARPAL BONE, is longer, thicker, and bigger, than any of the rest, and supports the fore Finger.

Its Basis is a little concave, answering to the digital Side of the Os Pyramidale of the Carpus. On the exterior Margin there is a small angular Scissure; and on the cubital Margin of the Basis, a small lateral Side, which is articulated with the Basis of the second Bone. The interior Margin is terminated laterally by an oblique Angle, which is articulated with the contiguous Angle in the Basis of the Os Magnum. Round the Basis are Inequalities and Depressions for the Ligaments and articular Glands.

Exteriorly, the Body of the Bone is broader toward the Head, than toward the Basis.

OS METACARPI MEDII DIGITI, or the second BONE, supports the middle Finger, and has this peculiar to it, that its Basis is very oblique, terminating at the exterior Margin, by an angular Apex, turned toward the first Bone. By the triangular Side of its Basis, it is articulated with the Basis of the Os Magnum; and by its lateral Sides, with those of the first and third Bones of the Metacarpus.

OS METACARPI DIGITI ANNULARIS, or the third BONE, supports the Ring Finger, being less than the first and second. Its Basis is irregularly triangular, and proportionably less than the two former; and by the principal Side thereof, it is articulated with the first half of the Side of the Os Unciforme. The small lateral Sides of the Basis join those of the second and fourth Bone of the Metacarpus.

## Lect. IX. Superior Extremities. 189

OS METACARPI MINIMI DIGITI, or the fourth Bone, supports the little Finger. The principal Side of its Basis, instead of being triangular, as in the other Bones, is all of an equal Breadth, a little oblique, and some Part of it gently convex, the rest gently concave, and articulated with the second Half of the Side of the Os Unciforme.

By its lateral Sides, it joins the corresponding Side of the Basis of the third Bone, but in a much looser manner, than in the other Articulations of the like kind. In the opposite Side there is small Tuberosity.

### OSSA DIGITORUM, OR THE BONES OF THE FINGERS.

The Fingers, make the third Part of the Hand, and terminate the whole superior Extremity. They are Five in Number in each Hand; called the Thumb, the Fore Finger, the Middle Finger, the Ring Finger, and the Little Finger.

They may be said, in general, to represent the same Number of compound, long, small bony Pyramids, convex on one Side, gently concave on the other, and joined by their Bases to the Carpus and Metacarpus, from whence they diminish gradually, and terminate in a sort of small Heads.

MAGNUS DIGITUS, OR THE THUMB, is the biggest of all the Fingers; next to that is the third, called the long Finger; the second and fourth are shorter than the third, the fourth being a very little longer than the second; the fifth is the smallest of all.

Each Finger consists of three Pieces, called Phalanges; the first of which is longer and thicker than the second, and the second than the third. Each Phalanx is divided in the same manner as an intire Finger, into a Basis, middle Portion,

tion, and Head; into two Sides, one convex, the other concave; and into two Margins. The Basis of the Phalanges remain Epiphyses for a long time, as well as the Heads of the metacarpal Bones.

The first Phalanx of the Thumb is not like those of the other Fingers. Antient Authors reckoned it among the Bones of the Metacarpus, which it resembles very much, and then they counted five metacarpal Bones, allowing only two Phalanges to the Thumb. The convex Side of this Phalanx is very much flattened, and broader toward the Head, than toward the Basis. On the concave Side, is a kind of angular Line, which, in some measure, distinguishes it into two Parts; its Head is like those of the metacarpal Bones, only flattened at Top.

The articular Side of its Basis is proportioned to the digital Side of the Os Trapezium, of the Carpus; and framed in such a Manner, as that the sigmoid Cavities and Eminences, in both Bones, cross each other. This Articulation has something very particular in it. It is a kind of double Ginglymus, which readily allows the Flexion and Extension, Adduction and Abduction, but with Difficulty permits the oblique Motions, because then the two Sides run counter to each other.

The Head and Basis carry, for a long Time, the Marks of Epiphyses; and for all these Reasons, this Bone may be reckoned a metacarpal Bone degenerated.

The second Phalanx of the Thumb is shorter than the first; its Body convex, or Semi-cylindrical on one Side, flat on the other, and contracted between the Margins. The articular Side of the Basis is a little concave, and surrounded near the Margins by small Tuberosities, as also near the Angle of the Phalanx. The Head is a regular  
Portion

## Lect. ix. Superior Extremities. 191

Portion of a Trochlea, which projects more on the concave, than the convex Side; and on both Sides there is a small Fossula and some Inequalities, in form of Tubercles. On the flat, or concave Side of the Phalanx, are two rough Lines, one near each Margin, which are often destroyed in cleaning the Bones.

They are the Impressions, or Marks, of the articular Vaginæ, which shall be explained in describing Cartilages and Ligaments.

The Connection of this Phalanx with the first, is by a kind of Arthrodia, or by a flat Enarthrosis, which permits a Motion in several Directions, though more limited than in other Articulations of the same kind. It is articulated with the third, by a very perfect Ginglymus.

The third Phalanx of the Thumb, represents the half of a sort of Cone; cut longitudinally, and by connecting it to the same Bone of the other Thumb, an intire Cone is formed. The convex Side is more even than the flat Side; and on each Margin, there is a Tuberosity near the Basis. The Basis has two concave Sides, which form a Ginglymus, with the Head of the second Phalanx. The Head small and flat, ending in a rough Semi-circular Border, which on the flat Side of the Bone, represents a Horse Shoe.

The other four Fingers in general and their Phalanges in particular, are all nearly of the same Structure, differing chiefly in Size. The fore\* and ring Fingers†, are almost equal, only the fore Finger is generally a little bigger, and sometimes a little shorter than the other. The middle Finger‡ is the longest, and the little Finger|| the

---

\* Demonstrationes vel Salutaris. † Annularis vel Cordis Digitus.  
‡ Impudicus Digitus. || Auricularis vel Minimus.

least, almost the same Proportions are to be observed in the Phalanges.

The first Phalanges of these four Fingers are made nearly in the same Manner, with the second of the Thumb; only they are longer in Proportion, flatter on the concave Sides, and more rounded on the convex Sides. The Margins of the flat Sides have the same rough Line, as the second Phalanx of the Thumb: Their Bases are concave, for their Articulation with the Heads of the metacarpal Bones, and their Heads are like Pulleys; as in the second Bone of the Thumb.

The second Phalanges are shorter, narrower, and thinner, than the first. Both Phalanges are gently incurvated, and resemble each other in Structure, except that the second contracts by degrees from their Basis, to the Heads, which are very small; and their Bases, have a double Cavity for their Articulation by a Ginglymus, with the Heads of the first Phalanges. Their flat Sides have the same rough Lines already mentioned.

The third Phalanges are in every thing like that of the Thumb, except that they are smaller; each of them being proportioned to the Finger they belong to.

It is to be observed concerning all the Phalanges, that their Bases have small Tuberosities, and their Heads, except those of the last Phalanges, have on each Side, a roundish sort of Fossula, bordered with small Eminences.





## LECTURE X.

### The CARTILAGES and LIGAMENTS of the SUPERIOR EXTREMITY.

#### CARTILAGES OF THE BONES OF THE SHOULDER.



THE Scapula, in many Subjects, has a small cartilaginous Border along its whole Basis, which, in Children, is remarkable enough; but in full grown Subjects it disappears.

The glenoid Cavity of this Bone is covered with a Cartilage, which is thicker toward the Circumference than in the Middle, and a little raised above its Margin. This Thickness of the cartilaginous Circumference makes the Cavity greater than it appears in the Skeleton; and sometimes, in lieu thereof, there is an additional Margin, which is thick at the Circumference of the Cavity, thin towards the Bottom, and very narrow. It is of a pliable slippery Substance, yet somewhat different from that of a Cartilage, resembling, in some Measure, the Margin of the cotyloid Cavity of the Os Innominatum.

The small cartilaginous Surface of the Acromium, mentioned in the Description of dry Bones, is thicker in the natural State, and very little convex.

## 194 Cartilages and Ligaments. Lect. x.

The small triangular Surface, at the Extremity of the Spine of the Scapula, near its Basis, is covered with a very thin, smooth, cartilaginous Lamina ; as being transparent, it does not appear very white.

There are no other Cartilages commonly found in the Scapula, though we sometimes observe in dry Bones, several Places which seem to have been cartilaginous, but this is owing to the dried Remains of Ligaments and Tendons.

The sternal Extremity of the Clavicle is crufted over with a Cartilage, which is a little convex, and covers its whole triangular Surface ; besides which it has another moveable common Cartilage, which is explained together with those of the Sternum.

The small cartilaginous Surface of the humeral Extremity of the Clavicle, answering to that of the Acromium, is much thicker in fresh, than dry Bones ; and appears, like that of the Acromium, to be a little Convex.

Between these two Cartilages of the Clavicle and Acromium, there is in some Subjects, a thin inter-articular Cartilage, very smooth on both Sides.

### LIGAMENTS OF THE BONES OF THE SHOULDER.

The Articulation of the Acromium with the Extremity of the Clavicle, is strengthened quite round by several small strong Ligaments, which go from one Bone to the other. These Ligaments lie very near each other, and are so tightly braced over the Joint, as to hide it altogether, and they appear more like a cartilaginous Covering, than a ligamentary Texture. The internal Surface of these Ligaments is lined with the articular Capsula.

## Lect. x. Cartilages and Ligaments. 195

When the small inter-articular Cartilage is found, its whole Circumference is connected to these Ligaments.

The Articulation of the Clavicle with the Sternum, is situated by several Ligaments fixed by one End, round the pectoral Extremity of the Clavicle, near the Edge of the triangular Surface, and from thence, passing over the inter-articular Cartilage, are inserted by the other End in the Sternum, in the manner hereafter to be related.

There is a long, narrow, strong Ligament, which goes from one Clavicle to the other, behind the Furca of the Sternum, being fixed to the internal Angle of the contiguous Extremities of the Bones, which may be called the inter-clavicular Ligament.

The Cervix of the Scapula, at a small Distance from the Margin of the glenoid Cavity, gives insertion to the capsular Ligament or mucilaginous Capsula, and to the articular Ligaments of the Articulation of the Scapula with Humerus.

Besides these articular Ligaments of the Scapula, there are three ligamentary Cords fixed to the Tuberosity of the coracoid Apophysis; two of which, by their other Extremities, are inserted in the oblique Eminence on the inferior Side of the humeral Extremity of the Clavicle; the third, under the Acromium. There is likewise a thin, flat, broad Ligament, reaching between the Crista of the Spine of the Scapula and the Margin of the inferior Costa.

### CARTILAGES OF THE OS HUMERI.

The Cartilage, by which the Hemisphere of the Os Humeri is covered, is gradually thicker toward the Middle, than toward the Margin.

The four Surfaces of its Tuberosities, which appear cartilaginous in dry Bones, serve only for

## 196 Cartilages and Ligaments. Lect. x.

the Insertion of the Tendons of four Muscles, which move the Humerus on the Scapula.

The Sinuosity, between the two Tuberosities, is partly covered by a thin Crust, which appears rather ligamentary than cartilaginous; and partly by a tendinous Stratum.

The Trochlea and small Head of the inferior Extremity of the Humerus are covered by a common Cartilage, in which the same Proportion of Thickness is observable, as in that of the superior Extremities. This is most common to all the convex articular Cartilages.

The Fossulæ, near the Pulley and small Head; are covered with a kind of thin Cartilaginous.

### LIGAMENTS OF THE OS HUMERI.

The capsular or mucilaginous Ligament loosely surrounds the whole Articulation of the Scapula with the Head of the Humerus. Form its Insertion round the Margin of the glenoid Cavity already mentioned, it is continued over the Hemisphere of the Head of the Humerus; and fixed near its Margins, towards the muscular Surfaces of the great and small Tuberosities.

Afterwards parting from them on both Sides, in the large Space left between the two Tuberosities, that is, between the small Tuberosity, and the inferior Surface of the great Tuberosity, it descends gradually on the Cervix of the Bone below the inferior Part of the cartilaginous Hemisphere.

In all its Course, the Capsula is closely fixed in the Bone, except in the small Space left between the two Tuberosities, that is at the Sinus already mentioned; where it forms a Production like the Tube of a Funnel, proportioned to the Capaciousness of the Sinuosity, and strongly fixed in the superior Portion thereof. This membranous Tube is  
the

the Vagina of the inter-articular Tendon of the Biceps, which shall be described in the Treatise of the Muscles.

The true Ligament of this Joint seems to be formed of two sorts of Ligaments closely united; viz. of a capsular Ligament which surrounds the whole Articulation, and of several true Ligaments which run over, and closely adhere to the former at different Distances.

Thus the Capsula, or mucilaginous Capsula of this Articulation is in part strongly united to four flat Tendons inserted in the two Tuberosities; and in part covered by true ligamentary Membranes, which, between the four Tendons, and on both Sides of the first and last, form a considerable Thickness. The rest of the Space, between the first or superior Plane of the great Tuberosity, and the small Tuberosity is so little provided with ligamentary Fibres, that it has been believed to be altogether without them; and Anatomists have satisfied themselves with telling us, that in these Places the orbicular Ligament is very rough externally, but shining and smooth internally.

The inter-articular Tendon of the Biceps, which has been already mentioned in speaking of the Production of the capsular Ligament of the Head of the Humerus, and which is contained in the Articulation, much after the same Manner as the inter-articular Ligament of the Head of the Femur, called improperly Ligamentum Teres, might be properly enough described in this Place, but I chuse to refer it amongst the Muscles.

On the Body of the Humerus, there are two particular Ligaments, which WINSLOW terms Inter-muscular or Lateral; they are long, flat, thin, strong, and narrow, fixed by one Margin, along the two inferior Thirds of the Bone; and reaching to both Condyles. They are braced pretty tight,

## 198 Cartilages and Ligaments. Lect. x.

and are very narrow superiorly, but broader toward the Condyles.

The inferior Extremity of the Humerus, is connected to the Bones of the Fore-arm, by the Fasciculi of ligamentary Fibres, one fixed to the internal Condyle, the other to the external.

Each Fasciculus is composed of Fibres, closely united at the Condyle, and afterwards parting in distant Membranes like a Goose's Foot.

The capsular Ligament is fixed to the Condyles and these cover them; and afterwards it is fixed round both Sides of this lower Extremity, above the Fossulæ. Its Insertion in the Sides is curved; so that it is there at a much greater Distance from the Articulation than the Condyles. The Fossulæ are slightly lined over with a cartilaginous Substance.

This Capsula appears to be strengthened by a Ligament, the Fibres whereof cross each other in different Directions; but we must not take for ligamentary Filaments, some tendinous Fibres of Muscles to which the Capsula adheres very closely: It appears larger and looser when the Muscles are separated from it, than in its natural State when closely united to the Muscles.

### CARTILAGES OF THE BONES OF THE FORE-ARM.

The two sigmoid Cavities in the superior Extremities of the Ulna are covered by a Cartilage common to both, which is a little interrupted about the middle of the Margin of the Cavities, by the transverse Scissures mentioned in the Treatise of dry Bones. This cartilaginous Crust seems to be thicker at the Margins than in the Middle.

The inferior Extremity, or small Head of the Ulna, is crusted over by a Cartilage, round its cylindrical Border, in the Scissure near the styloid Apophysis

## Lect. x. Cartilages and Ligaments. 199

Apophysis, and for some Space on the Apophysis itself.

The Cartilage, which covers the Head of the Radius, is likewise extended over the cylindrical Margin thereof; and a lateral Portion of the muscular Tuberosity immediately below the Cervia, is also covered with a thin shining Cartilage.

The lateral Semi-sinus of the Basis of this Bone, appears likewise to be crufted over with a cartilaginous prominent Line. The natural Sciffure of the Basis is likewise covered by a Continuation of the same Cartilage.

At the Basis of the Radius there is also a particular additional Cartilage, or triangular Production, longer than it is broad, very thin, and rather flat than concave on both its smooth Sides. It is fixed by its Basis, or shortest Side, to the lateral sigmoïd Sciffure of the Basis of the Radius, in such a Manner, that one Side of it is on a Level with the large cartilaginous Surface of the Basis of the Bone, and its Apex directly opposite to the styloïd Apophysis. The other Side touches the flat Extremity of the small Head of the Ulna, but is not fixed to it; and may be termed the inter-articular Cartilage of the Articulation of the Wrist. It is tied to the Radius by very short Ligaments, and sliding on the small Head of the Ulna, it follows all the Motions of the Radius.

It is therefore a sort of particular Production of the inferior Side of the Basis of the Radius, and fills in the natural State, the void Space, which, in the Skeleton, appears between the End of the Ulna and the neighbouring Bone of the Carpus.

### LIGAMENTS OF THE BONES OF THE FORE-ARM.

Some of these Ligaments, are common to them with the Humerus, others with the Bones of the Hand; and some are proper. These last

## 200 Cartilages and Ligaments. Lect. x.

are two one called the inter-osseous Ligament of the Fore-arm, and another which may be termed the coronary Ligament of the Radius. To these may be added the annular Ligaments, which only serve for the Passage of Tendons and other ligamentary Expansions, which may be named Muscular Ligaments.

The inter-osseous Ligament of the Fore-arm is very like that of the Leg. It is fixed by one Margin, along the acute Angle of the Ulna, and by the other along that of the Radius. It is principally composed of two very strong Laminæ of Fibres, which cross each other at oblique Angles, and leave Apertures at different Distances for the Passage of the sanguineous Vessels.

This Ligament ties the two Bones closely together, and the two Laminæ serve for the Insertion of several Muscles.

In the Supination of the Hand, it is very tightly braced; but in Pronation, it is folded a little longitudinal.

The coronary Ligament of the Radius is a sort of ligamentary Capial, surrounding the circular Circumference of the Head of that Bone, reaching from one Side of the small lateral sigmoid or transverse Cavity of the Ulna to the other, circularly about three Quarters.

It is very strong, and comes near the Solidity of a Cartilage. The Side next the Radius is very smooth, and though it connects that Bone very closely to the Ulna, yet it leaves it room enough to turn, in the Motions of Pronation and Supination.

The capsular Ligament of the Articulation of the Cubitus, runs down from its Insertion in the Humerus, already described, and is fixed in the Olecranon, round the Margin of the great sigmoid Cavity, including both the Apex of the Olecranon and of the coronoid Apophysis.



## Lect. x. Cartilages and Ligaments. 201

It likewise runs over the Head of the Radius, and is fixed to the coronary Ligament, quite round. Thus it completely furrounds the Articulation of the three Bones, and serves to contain the mucilaginous Liquor furnished by the Glands and fatty Substance, both which are found in the greatest Quantities near the Extremity of the Ulna.

The true common Ligaments, by which the Os Humeri is connected to the Bones of the Fore-arm, called lateral Ligaments, are the two Fasciculi, which, after being inserted in its Condyles, are expanded like a Goose's Foot. That which is fixed in the interior Condyle, may be called Brachio-Cubitale, and the other Brachio-Radiale.

The brachio-cubital Ligament descending over the Capsula, to which it closely adheres, below the great Margin of the Trochlea of the Humerus is inserted like Radii (of which its other Extremity fixed in the Condyle is the Center) on the Side of the great sigmoid Cavity of the Ulna. It is covered externally by several Tendons, which adhere closely to it, and seem to strengthen it.

The brachio-radial Ligament is disposed much after the same Manner, but is of a greater Extent. It is expanded from the external Condyle of the Humerus, as for a Dent, and is inserted round the coronary Ligament, and from thence down to the Cervix of the Radius, and also in the adjacent Parts of the Ulna. Through all this Passage, it covers the capsular Ligament, and is covered by several Tendons, adhering closely to both.

Of the Ligaments by which these Bones are connected to those of the Hand, one is like a roundish Cord, fixed in the styloid Apophysis of the Ulna, and from thence passes directly over the Os Cuneiforme of the Carpus, in which, and in other Bones it is inserted in the Manner we shall afterwards

## 202 Cartilages and Ligaments. Lect. x.

wards explain : Another pretty broad Ligament is fixed in the Apex of the Radius, and by its other Extremity with the Bones of the Carpus.

From this styloid Ligament of the Radius, along each Margin of the Basis of that Bone are Ranks of ligamentary Fibres lying much in the same Direction with the Ligament itself, and continued all the way to the styloid Ligament of the Ulna ; those nearest the Ulna inclose the inter-articular Cartilage of the Basis of the Radius, and near the styloid Ligament of the Ulna, there is a particular Fasciculus inserted in the Apex of that Cartilage.

All these Ligaments surround and cover the capsular Ligament so closely, that they can hardly be distinguished from it. The Capsula is likewise in Part covered by a Portion of a great oblique Ligament, which being by a very broad Insertion fixed in the large Extremity of the Radius, about two Fingers Breadth above the styloid Apex, afterwards crosses obliquely, partly over the convex Side of the basis Radii, and partly over that of the Carpus, and then turning toward the Os Orbitale, is inserted therein. It is called the external transverse Ligament of the Carpus ; and may likewise be named the great oblique Ligament of the Wrist.

There are several small annular Ligaments placed at different Distances on the convex Side of the Basis Radii, from its styloid Apex to its Articulation with the Extremity of the Ulna. They are at least six in Number, some of them being often double or triple.

The first, is fixed in the styloid Apex ; the second, in the Sinuosity near that Apex ; the third, in the small narrow middle Sinuosity ; the fourth, in the Sinuosity next the former ; the fifth, in the semi-lunar Scissure of the Basis, at its Articulation  
with

## Lect. x. Cartilages and Ligaments. 203

with the Ulna; and the sixth in the Extremity of the Ulna, near the styloid Apophysis.

These particular Ligaments are almost covered by the great oblique Ligament already mentioned, and are fixed as strongly in it by one Side, as they are in the Bones, by the other. They are all very strong, and their concave Sides, serving for Fræna to the Tendons of several Muscles that pass over them, are very smooth, and accompanied with thin mucilaginous Vaginae, which shall be described with the Muscles.

To these we might add the ligamentary Expansions, with which several Muscles are covered, and separated from each other, as by so many distinct Septa, which are all very thick and strong, where they are inserted in the Bones.

One kind of them may be termed ligamentary or muscular Vaginae, the other ligamentary Septa, inter-muscular Ligaments, &c. but the Description of them must be referred to that of the Muscles.

### CARTILAGES OF THE BONES OF THE HAND.

All the Bones of the Carpus, Metacarpus, and Fingers, are crufted over with Cartilages at these Places, which I termed cartilaginous Surfaces in the Treatise of dry Bones; but in fresh Bones they are thicker, softer, and whiter, than in the Skeleton.

In adult Subjects, their Figure remains the same in both, but it changes in the dry Bones of younger Subjects, and in those of Children it is quite different. The Impressions and Scissure in which the mucilaginous Glands are lodged, are most sensible in the Cartilages of fresh Bones; because of their Thickness.

## LIGAMENTS OF THE BONES OF THE HAND.

The Ligaments of the Carpus are very numerous. Some of them tie each Bone to one or two adjacent Bones in the same Rank; and these are composed of a great Number of Filaments, but so very short as to allow these Bones only a small Degree of Motion. Some of them tie the Bones of one Row to those of the other; which are likewise made up of many Filaments, but not so short as the former, and therefore allow these Bones a more manifest Motion, as we see in Flexion of the Wrist.

Lastly, There are other Ligaments of the Carpus, by which the three first Bones of the first Row are connected to the Bones of the Fore-arm; and to these may be added the Ligaments by which the Bones of the second Row are joined to those of the Metacarpus, and first Phalanx of the Thumb.

We have already described all the Ligaments belonging to the Articulation of the Carpus with the Bones of the Fore-arm, except their Insertions in the Carpus. The styloid Ligament of the Radius is fixed round the neighbouring Tuberosity of the Os Scaphoides. The styloid Ligament of the Ulna is fixed first in the Os Cuneiforme, and then in the Os Uneiforme, from whence it is a little stretched over the fourth Bone of the Metacarpus.

The Ligaments which lie between the two former, round the Basis of the Radius, and a small Portion of the Head of the Ulna, are fixed round the common Convexity of the three first corporal Bones, as is also the mucilaginous Capsula by which these Ligaments are lined.

Besides all these small short Ligaments belonging to each Bone in both Rows, the rough Surfaces of all the Bones, especially those which form the Convexity of the Carpus, give Insertion to a  
great

## Lect. x. Cartilages and Ligaments. 205

great many ligamentary Fasciculi, extended over, and closely united to the former small Ligaments, and serving probably to strengthen them. Some Fasciculi of the same kind are found on the concave Side of the Carpus, but they are fewer in Number, and not so strong.

There is likewise a considerable Ligament, called the interior transverse Ligament of the Carpus. It was formerly called an annular Ligament, and may still very properly retain that Name, in the Sense already explained when we spoke of Ligaments in general.

The Bones of the Metacarpus, besides the short Ligaments by which they are tied to the second row of Bones of the Carpus, have several others, by which both their Bases and Heads are connected together.

The Basis of the third and fourth Bones are not so closely tied as the rest, and therefore they have a very sensible Motion, which, however, is greater in the fourth, than in the third.

The Heads of these Bones are firmly tied to each other, by a strong transverse Ligament situated in the Palm of the Hand, and fixed by distinct Productions, in the neighbouring Part of the Heads, in such Manner as to form in the Spaces between the Heads, a kind of perforated Fræna, through which the Tendons of the Flexor Muscles of the Fingers have a free Passage; and these Fræna are also supported by aponeurotic Expansions, which shall be described in the Treatise of the Muscles.

The first Phalanx of the Thumb, is fixed to the Os Trapezium, by short Ligaments, which pass obliquely over the Articulation. The first Phalanges of the other Fingers are articulated to the Heads of the metacarpal Bones, almost in the same Manner, and by Ligaments like the former,  
which

## 206 Cartilages and Ligaments. Lect. x.

which are strengthened by adhering to the transverse Ligament already mentioned. The second Phalanx of the Thumb is articulated to the first by Ligaments of the same kind.

The third Phalanx of the Thumb is articulated to the second; the second Phalanges of the other Fingers to the first, and the Third to the Second, by lateral Ligaments, almost in the same Manner as the Bones of the Fore-arm, to the Humerus, that is, these Ligaments spread from a Point fixed in the lateral Tubercles of the Heads of the Phalanges, and are inserted by their other Extremity like Radii in the Bones of the contiguous Phalanges.

The two Phalanges of each Finger have a very strong ligamentary Vagina inserted in the rough Lines or Ridges on their flat Sides. These Vaginae are lined with a mucilaginous Membrane, which runs like a Tube from one Phalanx to the other, over the Articulation. They serve for Frænæ to the Flexor Muscles of the Fingers, the Tendons of which pass through them.

### OBSERVATIONS.

#### THE PARTICULAR SITUATION AND USES OF THE BONES OF THE SUPERIOR EXTREMITIES.

The Hand is generally represented in Skeletons and Figures as lying in the same Plane, and in the same longitudinal Direction with the Bones of the Fore-arm. This gives a very false Idea of its true Situation, which, with respect to the Fore-arm, is oblique in two Respects. The Back of the Hand is inclined upon the convex Side of the Carpus, and makes an Angle with the Fore-arm, and besides, the fourth Bone of the Metacarpus is inclined towards the Ulna in particular; in a Word, the Breadth of the Hand makes an Angle with the Breadth,

## Lect. x. Cartilages and Ligaments. 207

Breadth of the Fore-arm, and the Thickness of the Hand at the same Time, with the Thickness of the Fore-arm. I mean here that Part of the Fore-arm, which is next the Hand.

This is owing to the Structure and Situation of the Bones of the Carpus, and to their Connection with those of the Fore-arm. First the two Rows of these Bones make a sort of transverse Fold on the convex Side of the Carpus, and the articular brachial Sides of the two first Bones of the first Row are turned a little toward the same convex Side of the Carpus. Which obliges the whole Hand to be a little bent back in its natural Situation. Secondly, the Margin of these Bones next the Ulna is much shorter than that next the Radius, which makes the cubital Margin of the whole Hand incline to that Side.

By not considering this, a large void Space is commonly left in Skeletons, between the Extremity of the Ulna and the Os Cuneiforme of the Carpus. We ought likewise to observe that the Margin of the Metacarpus next the Ulna is shorter than the other, so that in the Metacarpus a small and great Margin may as justly be distinguished as in the Carpus.

In this oblique and natural Situation of the Hand, the Fingers being extended and a little separated, the Extremity of the fore Finger will be found to answer to the Interstice between the Bones of the Fore-arm, and if in this Situation we make alternately the Motions of Pronation and Supination, the Extremity of the fore Finger will be found to be in some Measure the common Center of these Motions.

This Description of all the Bones of the Hand is moreover very well contrived, to give it several kinds of Attitudes ; for by Means thereof, it may be lengthened, flatted, shortened, and contracted.

The

## 208 Cartilages and Ligaments. Lect. x.

The Hand is lengthened or widened, and flatted by extending all the Fingers and turning back the Thumb, which is what is called extending or opening the Hand. It is shortened by bending all the Fingers; whether in what is called closing the Fist, or in grasping any thing; and to this the Situation of the Thumb, and the oblique Disposition of the Bones of the Metacarpus and Fingers contribute in a particular Manner. And as in this Case the Thumb counter-balances all the other Fingers, the Articulation of the first Phalanx thereof, with the Os Trapezium, appears to be rendered more firm and steady, by partaking a little of the Nature of a Ginglymus, without hindering its other Motions. Lastly, The Hand is contracted, and made into a sort of Sulcus or Furrow, by the Adduction of the Thumb, and the easy Motion of the fourth metacarpal Bone already mentioned. And if, at the same time, we bend the Fingers and press them close together, we both shorten and contract the Hand, and thereby form a Hollow, which is called **DIOGENES'S Cup**.

In the Fingers we ought likewise to remark, that though the Articulation of the second Phalanx of the Thumb, and first Phalanges of the other Fingers be moveable in many Directions, and framed nearly in the same Manner as that of the Humerus with the Scapula; yet these Phalanges cannot be moved round their Axis. This is not owing to their Conformation, but to the Want of proper Muscles, as we shall see afterwards. The same thing cannot be said of the first Phalanx of the Thumb, because though it had proper Muscles, yet the kind of half Ginglymus, by which it is articulated, would not allow of such a Motion.

The Thumb is situated differently from the other Fingers. The Fingers, both with Respect to their Sides and Margins, have in their natural  
 Situation



## Lect. x. Cartilages and Ligaments. 209

Situation, nearly the same Direction with the Plane of the Metacarpus. The Thumb, being in its natural Situation, and free from the Action of all its Muscles, its convex Side answers to the convex Side of the Radius, and its flat Side is turned toward the little Finger; and the first Phalanx makes a hollow Angle with the Radius, and a prominent Angle with the second Phalanx; but both this and the third Phalanx lie in a straight Direction like that of the Fore-arm.

The Carpus is the Basis and Center of all the Motions of the Hand, except that of Rotation: by Means thereof we can bend the Hand in all Directions, but with more Ease toward the Sides and Margins than any other way. The four Bones of the second Row may have a small Degree of Motion on the first, such as Ginglymus can allow of.

The Radius is in a manner the Handle of the Hand, and it is chiefly by means thereof, that we can move it reciprocally, as on an Axis turning either Margin of it toward the Body. When the radial, or great Margin is turned to the Body, this Motion, or Attitude is termed Pronation; and when the cubital, or small Margin is toward the Body, it is termed Supination. In the natural and most ordinary Situation of the Hand, the Palm is turned toward the Body, and not the Margins.

This Disposition of the Hand determines the true Situation of the Radius, which is not on one Side of the Ulna in a parallel Direction, as the Figures of Skeletons commonly represent it, but the Radius crosses the Ulna obliquely in such a manner, as that the styloid Apophyses, in both Bones, are directly over against each other. This is its true natural Situation. The Radius being bent, may be still further crossed over the Ulna, than in its natural Situation; and this happens in

## 210 Cartilages and Ligaments. Lect. x.

Pronation, but in Supination it is parallel to the other Bone.

The Ulna supports the Handle of the Hand, without being itself articulated with it. Two lateral Ginglymi and very strong Ligaments connect the Radius closely with it; so that in the most violent Motions, these two Bones cannot be separated. When we push or press any thing with the Hand, the whole Force is sustained by the Radius, the Basis of which supports the Wrist, and its concave Head is strongly pressed against the small inferior Head of the Os Humeri, the oblique Direction of the Pulley of the Ulna is the Reason that, in bending the Fore-arm upward, the Extremity of that Bone is naturally turned toward the Thorax, and not without Difficulty toward the Articulation of the Scapula.





# LECTURE XI.

## The INFERIOR EXTREMITIES.

### OS FEMORIS.

**T**HE FEMUR is the biggest and longest Bone of the Skeleton. Its Figure comes near that of a Cylinder, and it is a little bent at the Middle.

It lies in the same Direction with the Trunk ; only a little obliquely, in such a Manner, as that the superior Parts of the two Bones are at a greater Distance from each other, than the inferior.

In the superior Extremity, we are to consider the Head, Cervix, and two Tuberosities, named Trochanters Major and Minor.

The Head is rounded like a Globe, or Ball, and covered with a very smooth Cartilage. Its Situation is obliquely exteriorly, and a little anteriorly ; so as that the greatest Portion of its Convexity lies superiorly, and the smallest inferiorly ; and the Cartilage extends farther on the anterior and posterior Sides, than on the other Sides.

A little below the Middle of its Convexity, there is a Fossula, nearly of a semilunar Figure, in which a Ligament is inserted in the natural State. The Femur of the Head is an Epiphysis in Children, and in some Subjects remains such for a long time,

and is therefore liable to be separated from the Cervix, by any violent Force.

The Cervix is an Apophysis, situated interiorly at the superior Part of the Bone, being inclined superiorly, and a little anterior, and making an Angle with the Body, more or less oblique; but in some Subjects, it lies almost transversely. Towards the inferior Part, it expands, into a kind of Basis; and at its middle narrow Part, we observe a rough superficial Impression, which surrounds it like a Collar.

The Trochanter Major is a large Tuberosity, lying on the exterior, and a little toward the posterior Part of the Basis of the Cervix. It is very high, and turned a little posteriorly, terminating in an obtuse Point, in which there is a Cavity or Fossula. Its Convexity is unequal, and distinguished into several Surfaces, which are muscular Impressions; and the like are found on its Margin and concave Side.

The Trochanter Minor lies on the posterior and inferior Parts of the Basis of the Cervix, being turned interiorly.

Between the two Trochanters, posteriorly, there is an oblong, oblique Eminence, which makes a sort of Communication between them, and lengthens out the Cavity, behind the Trochanter. Anteriorly, there is likewise a broad oblique Line, sometimes considerably raised, which runs between the two Apophyses, and terminates the Basis of the Cervix anteriorly.

The inferior Extremity of the Femur is broader and thicker; being, as it were, the Basis of the whole Bone. We observe in it two large articular Eminences, situated laterally with Respect to each other, which are separated and very prominent, on the posterior, but united like a Pulley on the anterior Side. They are called Condyles; and with

## Lect. XI. Inferior Extremities. 113

with respect to the Length of the Body of the Bone, the internal Condyle is longer, and reaches inferior than the other; but Regard being had to the Obliquity of the Bone, there is very little Difference between them, both lying nearly in the same horizontal Plane.

The external Condyle is broader, and advances anteriorly than the other.

They are covered with a smooth Cartilage, and though they both make but one Body, they are, in some measure, distinguished, on the anterior and inferior Sides, by a superficial Depression, after the manner of a Pulley, and behind, they are parted by a deep round Fossa.

In this large Fossa or Sciffure, there are several small Foramina; and likewise two superficial and pretty broad semilunar Impressions, one at the inferior Margin of each Condyle; that on the internal Condyle, being situated anteriorly, and the other a little posteriorly.

On the Side of each Condyle, there is a Tuberosity, and behind that a muscular Impression, together with a small cartilaginous Surface; on which lies a kind of sesamoid Bone, as we shall see in describing the Muscles.

The Body, or middle Portion, of this Bone represents a Pillar or Cylinder bent anteriorly.

We may however distinguish three Sides in it, one anterior, which is more rounded in the middle, than in the superior and inferior Parts; and two posterior, more flat than the former, and separated by a long angular Ridge, called *Linea Aspera*, which is rough, unequal, and very prominent, and seems to arise from both Trochanters.

On the exterior Side of this Ridge, superiorly, there is a rough longitudinal Mark, a little depressed inferiorly at the Extremity. Below, the *Linea Aspera* is divided into two, each running in the

Direction of the Condyles; but being soon lost after the Division, a flat triangular Surface, very broad near the Condyles, comes in its Place. The external Line is more prominent than the internal, till they both bend.

There is likewise another oblique unequal Line, before and under the Trochanter Minor, which, as it descends, unites with the Linea Aspera. All these Lines, Ridges, and Depressions, are for the Insertion of Muscles; about the middle of the Bone posteriorly, we see sometimes one Foramen, sometimes more, for the Passage of sanguineous Vessels and Nerves.

The natural Direction of the Femur is not perpendicular, but oblique; the superior Extremity being inclined externally, the inferior Extremity interiorly; so that the two Bones, as has been already said, are at a greater Distance above than below; and from hence we see the Reason, why the internal Condyle appears to reach lower down than the external, when we view a single Bone.

This Bone is spongy at the Extremities, and concave in the Middle; the Cavity being filled with reticular Substance, and Portions of Laminæ detached from each Side.

It is articulated above, by Enarthrosis, with the Os Innominatum; its Head being received into the Acetabulum; below, it is connected with the Tibia, by a particular Kind of Ginglymus.

#### OF THE BONES OF THE LEG.

The TIBIA is a long Bone irregularly triangular, and much larger at Top than below. Its Name is taken from the Resemblance it bears to a kind of Pipe or Flute used by the Ancients.

The superior Head, or Extremity, of the Tibia consists of two Condyles, the superior Side of which  
is

## Lect. xi. Inferior Extremities. 215

is flat and divided into two cartilaginous Surfaces, almost horizontal, and a little concave; one internal, the other external. Between these lies a cartilaginous Tuberosity, which appears to be double, and has Inequalities both on the anterior and posterior Part, for the Insertion of Ligaments. The two Surfaces answer to the two Condyles of the Os Femoris.

The Internal is somewhat oblong, from the anterior to the superior Part, and a little more depressed than the other. The External is rounder, and descends a little posteriorly. The whole Head, taken transversely, is oval, except toward the posterior Part, where there is a superficial Scissure; and the Circumference is very rough.

The external Condyle is more prominent than the internal; and on its inferior Part, a little posteriorly, there is a small cartilaginous Surface for the Articulation of the Fibula.

On the anterior Part of the Head, there is an unequal Tuberosity, called the Spine, for the Insertion of the tendinous Ligament of the Patella.

All that Part of the Head, which lies above the Level of the Spine, is Epiphysis in Children; and the Spine is originally an Epiphysis, distinct from the other; but it afterwards becomes an Apophysis of the Head of the Tibia.

The inferior Extremity is neither so thick, nor so broad as the superior. It may be considered as its Basis, and on its exterior Side there is a longitudinal Depression, broader inferiorly, than superiorly; which receives the Extremity of the Fibula.

On the interior Side of the Basis, there is an Apophysis called Malleolus Internus, which descends down lower than any other Part, and has posteriorly a Sulcus for the Passage of a Tendon.

The Basis of the Tibia terminates in a transverse, oblong, cartilaginous, articular Cavity; the

Capacity of which is increased interiorly by the Malleolus Internus, the Cartilage being likewise continued over that Side of it, which is turned toward the Cavity. Through the Middle of this Cavity, a superficial Eminence runs, by which it is divided into a right and a left Portion.

All the inferior Portion of the Basis of the Tibia together with the Ankle; is Epiphysis in Children, and the Marks thereof remain for a long time after the Ossification is perfected.

The greatest Breadth or longest Diameter of the Basis of the Tibia does not lie in the same Plane with that of the Head, the Ankle lying a little interiorly than the internal Condyle. This Observation is of great Consequence in Fractures and Luxations of this Part.

The Body of the Tibia is in a manner triangular; one external, and one posterior; and into three Angles, one anterior, called the Crista of the Tibia, and two posterior.

The internal Side is the broadest of the three, very equal, gently convex, being distinguished into three Sides, one internal, and turned a little anteriorly. The external Side is unequally flat, and narrower than the former. The posterior Side is unequally rounded, and the narrowest of all. At its superior Part, however, it is of a considerable Breadth, and there we observe a long, oblique, muscular Impression, beginning under the Scissure in the posterior Part of the Head, and from thence descending internally. Immediately below the Extremity of this Impression, there is another less oblique.

The anterior Angle, or Crista, is acute, prominent about the Middle, and almost round at the inferior Part. It might be reckoned a Continuation of the Tuberosity, or Spine. The internal posterior Angle is something rounded, the external



nal is more acute, except toward the superior Part, where it is more or less flattened.

The Substance of the Tibia is the same with the other long Bones. It is connected above, with the Condyles of the Os Femoris, by an Articulation, which is partly a Ginglymus, for the Extension and Flexion of the Leg, and partly an Arthrodia, for the Rotation of the Leg, when bent. This is owing to two intermediate Cartilages, which shall be examined in the Description of the fresh Bones.

### THE FIBULA, OR PERONÆUS.

It is a small long Bone, irregularly triangular, lying on the exterior Side of the Tibia, almost opposite to the external posterior Angle, but a little posteriorly.

The superior Extremity is a kind of Tuberosity, or Head, obliquely flattened by a small cartilaginous Plane, by which it is articulated with the cartilaginous Surface at the inferior Part of the external Condyle of the Tibia. It terminates posteriorly by a kind of short obtuse Apex directed superiorly.

The inferior Extremity is broader, flatter, and more oblong than the superior. It is partly a Continuation of its Body, and partly an Epiphysis in Children, the Marks of which are quite lost in an advanced Age. It has in a manner three Sides, one rounded like a Tuberosity, one flat, and the third narrow. When it is placed in the lateral Cavity of the Basis of the Tibia, it makes the external Ankle, opposite to the internal Ankle. In its natural Situation, inclines much inferiorly than the Basis of the Tibia, and terminates in a Point turned a little posteriorly.

The

The flat Side is cartilaginous; and turned toward the cartilaginous Side of the internal Ankle, with which, and with the inferior Side of the Basis of the Tibia, it completely forms the Cavity by which the Leg is articulated with the Foot. The narrow Side is turned posteriorly, and near its inferior Part is a small, oblong, unequal Fossula, formerly believed to be for the Passage of a Tendon, in which a small mucilaginous Gland is lodged. The Point by which the Basis of the Fibula ends, has a small smooth Surface immediately below the narrow Side, for the Insertion of an annular Ligament.

The Body of this Bone, is long and small, more or less contorted, and irregularly triangular. Near the two Extremities, it contracts into a kind of Cervix, and a little below the Middle, it is often bent internally, but this Curvature may be chiefly owing to the Method of dressing Children, for we sometimes meet with this Bone very strait. It is distinguished, in an irregular Manner, into three Sides and three Angles, principally towards its inferior Part.

The External is the most considerable: The Semi-superior of it is more or less concave; afterwards it grows round; and, altering its Direction, becomes almost posterior in its Semi-inferior. The posterior Side is more or less convex superiorly; then it grows flat, and, turning in the same Manner as the former, becomes nearly internal toward the inferior Part.

The interior Side has likewise a Turn below its Middle, and becomes anterior, from thence inferiorly; and this Turn is marked by an oblique Line, which descends on this Side from the posterior to the anterior, and divides it into two. These Sides serve partly for Muscles to lie upon, and partly for their Insertions.

The internal Structure of the Fibula, though a very small Bone, is like that of the other long Bones.

## Lect. XI. Inferior Extremities. 219

**Bones.** It is articulated by its superior Extremity with the inferior Surface of the external Condyle of the Tibia. This Articulation is an Arthrodia, with a very small Degree of Motion. The inferior Extremity is articulated by its cartilaginous Side, partly with the lateral Depression in the Basis of the Tibia, and partly with the first Bones of the Foot, completing the Ginglymus between the Leg and that Bone.

The internal Angle of the Fibula answers to the external posterior Angle of the Tibia; and both serve for the Insertion of the inter-osseous Ligament of the Leg; the other two Angles are more or less sharp, especially the anterior, which is sometimes like a kind of Crista, and terminates before, in a small triangular Surface.

### THE PATELLA, OR ROTUNDA.

It is a small Bone, situated above the Spine of the Tibia, somewhat resembling a large Chestnut, is about half as thick as long, and its Length and Breadth are nearly equal.

Its Basis is the superior and thickest, where several tendinous Impressions are observable, which descend a little on the convex Side. The Apex is obtuse, and serves for the Insertion of a strong Ligament, which ties the Patella to the Spine of the Tibia.

The anterior Side is convex, with some small Inequalities and Sulci on it. The posterior Side is concave, covered with a Cartilage reaching near the Apex, and terminating at an unequal Cavity, or Fossula, which is an Impression for the Ligament already mentioned.

This cartilaginous Side is parted in two by a Ridge, which goes between the Basis and Apex; and the two Parts are exactly suited to the Pulley of the Femur, being externally broader than internally,

ternally, which is likewise observable in the Pulley.

The Patella remains long and cartilaginous ; in ossifying, it becomes intirely cellulous, except the Surfaces of its two Sides and the Impressions.

It is connected with the Tuberosity of the Tibia, by a thick strong Ligament, which may be looked upon as particularly belonging to the Tibia, or as a moveable Olecranon, which is as fixed to the Patella.

### THE BONES OF THE FOOT.

The Foot is the third Portion of the inferior Extremity, and is divided into three Parts, the Tarsus, Metatarsus, and Toes.

The Tarsus consists of seven Bones, much larger than those of the Carpus, the Names of which, in the Order in which they are commonly described.

The particular Division of each of these Bones, and indeed of all the Bones of the Foot, are much more easy than in the Bones of the Hand, because the Foot remains always in the same Attitude ; and therefore the anterior, posterior, superior, inferior, lateral, and other Parts, may be certainly fixed, without any Danger of mistaking.

According to the natural Situation of the Foot, and its Connection with the Leg, the Astragalus is the superior and first Bone of it. This Bone may be divided into two Portions, one large and posterior, which is, as it were, its Body ; one small and anterior, which is an Apophysis, or the anterior Portion. The Body, or posterior Portion, has four Sides, one superior, two lateral, and one inferior. The superior Side is the largest, covered all over with a Cartilage cylindrically convex, from the anterior, to the posterior, with a Depression running through the Middle of its Breadth, which

which represents half a Pulley, and continuous with the two lateral cartilaginous Sides, of which the external is broader than the other. This superior Side is articulated with the inferior Side of the Basis of the Tibia; the internal lateral Side with the inner Ankle; and the external lateral Side with the outer Ankle. Below the internal lateral Side, there is a great Depression without Cartilage, and several other Inequalities.

Inferiorly likewise it is cartilaginous and obliquely concave for its Articulation with the Os Calcis; at the inferior and posterior Part of the Body of the Astragalus, on the Margin of the inferior Side, is a small, oblique, smooth Scissure, for the Passage of Tendons.

The Apophysis, or anterior Part of the Astragalus, is distinguished from the Body, by a small Depression superiorly; and inferiorly, by a long, oblique, unequal Scissure, very broad toward the external. The anterior Side of this Apophysis is all cartilaginous, and obliquely convex, for its Articulation with the Os Scaphoïdes.

The inferior Side, likewise cartilaginous, is parted in two, and articulated with the Os Calcis; being distinguished from the inferior Side of the Body of the Bone, by the long oblique Scissure already mentioned. Besides these two cartilaginous Sides, there is a third below the anterior interiorly, which, in the Skeleton, touches nothing.

The Os Calcis is the largest Bone of the Foot; which makes the posterior Part, and in some measure the Basis. It is oblong and very irregular, and may be divided into a Body and two Apophyses; one great and anterior, the other small, lateral, and internal.

The Body of the Os Calcis has six Sides, one posterior, one anterior, one inferior, one superior, and two lateral.

The

The posterior Side is broad, unequally convex, and, as it were, divided into two Portions, one superior, small, and polished; the other inferior, much larger, unequal, and rough, which, in Children, is an Epiphysis; and may be named the Tuberosity of the Os Clavis: The inferior Part of it is bent inferiorly, and terminates in two Tubercles, or obtuse Points, which belong rather to its inferior than to its posterior Side.

The superior Side may be divided into two Parts, one posterior and unequal, having a small Depression; the other anterior, convex, and cartilaginous, proportioned to the great inferior Cavity of the Astragalus anteriorly, and, by this Obliquity, becomes Part of the anterior Side; the remaining Part of which is lost in the anterior Apophysis. It is inferiorly narrow, and behind it lie the two Tubercles, already mentioned, of which the internal is the biggest. They both serve for the Insertion of the Aponeurosis in the Sole of the Foot, but chiefly the biggest.

The two lateral Sides are continued over the anterior Apophysis. The external is gently convex and unequal, covered only by the common Integuments, and Ligaments. The internal is concaved and depressed.

The great, or anterior Apophysis, lies in the same Direction with the Body, being a Continuation thereof. It has five Sides, or remarkable Parts, and were it not for the Body, it would have a sixth.

The superior Side has an irregular and unequal Depression, which, together with that in the Apophysis of the Astragalus, forms a considerable Fossa; at its anterior Extremity, there is a small cartilaginous Surface, answering to one of those in the Apophysis of the Astragalus. The anterior Side of the Apophysis is broad, oblique, cartilaginous, partly convex and partly concave, and articu-

## Lect. XI. Inferior Extremities. 223

articulated with a like Surface of the Os Cuboïdes. This is the fore Side of the whole Os Calcis, when considered without any Division.

The exterior Side of the Apophysis is very rough, being a Continuation of the external Side of the Body, with a Tubercle, or Eminence, at the Place where these two Sides meet, which however is not found in all Subjects. On the inferior Part of this Tubercle, is a cartilaginous Surface for the Passage of the Tendon of the Peronæus Longus. Sometimes we see only some small Vestiges of this Eminence, and often none at all. We sometimes meet with another small, cartilaginous, inferior Surface, which is anteriorly near the anterior Extremity of the Apophysis, for the Passage of the same Tendon.

The inferior Side is a Tuberosity continued from the Side of the Body, and designed for the Insertion of Muscles.

The lateral Apophysis is almost common to the Body, and to the great anterior Apophysis, and increases the Cavity on the Inside of the Os Calcis.

On its superior Part, it has a very smooth cartilaginous Surface, articulated with one of the inferior Surfaces of the Astragalus. This Apophysis is very inferior, and its inferior Part is smooth for the Passage of Tendons.

The Os Scaphoïdes, called also Os Naviculæ, from its Resemblance to a little flat Boat, lies before the Astragalus. It has two cartilaginous Sides, an oval Circumference, and a Tuberosity; its Thickness is inconsiderable, when compared with its other Dimensions, and it lies, as it were, on its Side before the Astragalus.

The concave Side is posterior, and articulated with the anterior convex Side of the Astragalus. The  
anterior

anterior convex Side is divided, by two small Lines, into three Planes, for the Articulation of the three *Ossa Cuneiformia*.

The Circumference forms an Oval, which contracts by small Degrees, and terminates in an obtuse Point. One Side of this Circumference is more convex and rough than the other, and the Inequalities in it serve for the Insertion of Ligaments.

The Apex of the Oval ends in a Tuberosity, marked with a muscular Impression; in the natural Situation of this Bone, the most convex Side is superior, the other inferior, and the Tuberosity interiorly and inferiorly.

By this Situation and the Difference of the Sides, it is easy to distinguish the *Os Naviculæ* of the right Foot from that of the Left. The small or inferior Convexity of the Circumference has, near the Tuberosity, a superficial Scissure; and on the opposite Side, a small cartilaginous Surface and a small Tubercle, for its Articulation with the *Os Cuboïdes*, and the Insertion of Ligaments.

The *Os Cuboïdes* is situated before the *Os Calcis*, on one Side of the *Os Scaphoïdes*. It is a Mass with six Sides, all very unequal and very irregular; and from these it has its Name.

The superior Side is flat and rough, for the Insertion of the Ligaments, which connect it with the neighbouring Bones.

The inferior Side has an oblique Eminence, and immediately below that a Sulcus, which is likewise oblique. The Eminence divides the Sides into two, and is a little cartilaginous on that Margin which touches the Sulcus: This Scissure appears to be cartilaginous from a Ligament which lines it, and both that and the Margin of the Eminence serve for the Insertion of an annular Ligament, and for the Passage of the Tendon, *Pernæus*



næus Longus ; poſteriorly, it is cartilaginous, broad, oblique, partly convex, and partly concave, anſwering anteriorly to the Os Calcis anteriorly, it is pretty broad, and divided into two Portions, by a narrow prominent Line, by which Portions, this Bone is articulated with the third and fourth Bones of the Metacarpus.

The internal Side is the longeſt of all ; it has a ſmall cartilaginous Surface, by which it is articulated with one of the Oſſa Cuneiformia. The reſt is rough with ſeveral Depreſſions, in which Veſſels and Glands are lodged.

Behind the cartilaginous Portion, there is, in ſome Subjects, another narrow Surface, which is articulated with the contiguous Portion of the Circumference of the Os Scaphoïdes ; this Articulation, when wanting, is ſupplied by Ligaments.

The external Side is the leaſt of all, irregular, ſhort, and narrow, and it has a Sciffure, which communicates with the Sulcus on the inferior Side.

The OSSA CUNEIFORMIA are three in Number, ſituated before the Os Scaphoïdes, and they have their Name from the Reſemblance they bear to Wedges ; the firſt is the longeſt, the third the largeſt, and the ſecond of a middle Size between the other two. With the Os Cuboïdes, they form a ſort of Arch, which, on the Side next the other Foot, is high ; and low on the oppoſite Side.

In each Side we may diſtinguiſh the Baſis, Apex, and four Sides ; one poſterior, one anterior, and two lateral ; whereof one is internal, the other external.

The firſt Bone is like a Wedge, contorted and bent ; its Baſis, which is unequally rounded like an oblong Tuberoſity, ſerving for the Inſertion of a Tendon.

The internal lateral Side, or that which is turned toward the other Foot, is unequally convex,

and rough for the Insertion of Ligaments; the external lateral Side, or that next the second Bone, is unequally concave and cartilaginous toward the superior and posterior Margin. The largest Portion of the Side is articulated with the second Bone; the rest toward the anterior Margin is joined laterally to the second Bone of the Metatarsus.

The posterior is the least, cartilaginous, and almost triangular, situated to the first of the three triangular Surfaces of the Os Scaphoïdes.

The anterior is cartilaginous, large, and semilunar; the convex Side being turned to the other Foot, and by this the first Os Cuneiforme is articulated with the first Bone of the Metatarsus.

The Angle is turned superiorly, and the Obliquity thereof occasions the anterior Side to be the highest, and the posterior the inferior.

The second Os Cuneiforme, the least of the three, has the Basis superiorly, and the Angle inferiorly, and resembles a Wedge more than the first. Its Basis is short and rough for the Insertion of Ligaments; the posterior Side is cartilaginous and perfectly triangular, situated to its Articulation, with the middle Surface of the convex Side of the Os Scaphoïdes. The anterior Side is also cartilaginous, a little more oblong, and articulated with the Basis of the second metatarsal Bone.

The two lateral Sides, have, toward their superior and posterior Margins, oblong cartilaginous Surfaces, by which they are articulated with the first and third Offa Cuneiformia. The rest of these two Sides is a little depressed, and thereby small Interstices, or void Spaces, are left between the Bones. This is every way the shortest Bone of the three. Its Angle is hid between the other two Bones, of the same Name, and does not reach so low as theirs, which makes this Part of the Foot a little concave.

The.

The third Os Cuneiforme, is of a middle Size, between the other two, has likewise its Basis upward, and its Angle downward. The Basis is longer than that of the second, almost flat, or very little convex, and rough for the Insertion of Ligaments.

The posterior Side is cartilaginous and triangular; that is; of the same Figure with the third Surface of the convex Side of the Os Scaphoïdes. The anterior Side is likewise cartilaginous and triangular, but a little oblong, being articulated with the Basis of the third Bone of the Metatarsus.

The internal lateral Side, is broad with two cartilaginous Surfaces, one toward the posterior Margin, the other toward the anterior. The first is for its lateral Articulation with the second Os Cuneiforme, the second for its Articulation with the Basis of the second metatarsal Bone.

The external lateral Side is likewise broad, and, toward its posterior Margin, has a large cartilaginous Surface for its Articulation with the Os Cuboïdes. Toward its anterior Margin there is a sort of void Space for the Passage of Vessels, and sometimes a little cartilaginous Corner for its lateral Articulation with the fourth Bone of the Metatarsus.

#### THE METATARSAL BONES.

The Metatarsus is composed of five Bones, which, in their general Characters, agree with the metacarpal Bones, but may be distinguished from them, by the following Marks, 1st, They are longer, thicker, and stronger. 2dly, Their anterior round Margins are not so broad, and are less in proportion to their Basis. 3dly, Their Bodies are sharper above, and flatter on the Sides, with their inferior Ridge inclined more externally. 4thly, The Tubercles

cles at the inferior Roots of the round Heads are larger.

The first, or metatarsal Bone is easily distinguished from the rest by its Thickness. The next to it is longest, and with its sharp Margin, almost perpendicular. The others are shortened more obliquely, as their Situation is more external: Which general Remarks, with the Description I am now to give of each, may teach us to distinguish what Bone, and to which Foot any one belongs, that can be offered to our Examination.

Os Metatarsi Pollicis is by far the thickest and strongest, as having much the greatest Weight to sustain. Its Base is oblong, irregularly concave, and of a semilunar Figure, to be adapted to the Os Cuneiforme maximum. The inferior Margin of this Base is a little prominent and rough, where the Tendon of the Peronæus primus Muscle is inserted. Externally, an oblique circular Depression is made by the following Bone. Its round Head has generally on its fore Part a middle Ridge, and two oblong Cavities, for the *Offa Sesamoidea*; and on the external Side a Depression is made by the following Bone.

Os Metatarsi of the second Toe is the longest of the five, with a triangular Base supported by the Os Cuneiforme Medium, and the external Side produced into a Process, whose Extremity is an oblique smooth Plane, to be connected to the Os Cuneiforme externum.

Near the internal Margin of the Base, this Bone has two small Depressions, made by the Os Cuneiforme maximum, between which is a rough Cavity. Farther forwards, we may observe a smooth Protuberance, which is joined to the foregoing Bone.

On its external Basis are two oblong smooth Surfaces for its Articulation with the following Bone;

## Lect. xi. Inferior Extremities. 229

Bone; the superior smooth Surface being extended longitudinally, and the inferior perpendicularly; between which there is a rough Fossa.

Os Metatarsi of the middle Toe is the second in Length. Its Basis, supported by the Os Cuneiforme externum, is triangular, but slanting externally, where it terminates in a sharp pointed little Process; and the inferior Angle is not completed.

The internal Side of this Basis is adapted to the preceding Bone, and the external Side has also two smooth Surfaces, covered with Cartilages, but of a different Figure; for the superior is concave and posteriorly round, and the little inferior smooth Surface is convex, and very near the Margin of its Basis.

Os Metatarsi of the fourth Toe is near as long as the former, with a triangular slanting Base, connected to the Os Cuboïdes, is very large, tuberosus, and produced into a long pointed Process externally; whence Part of the Abductor minimi Digiti has its Origin; and superiorly the Peronæus secundus is inserted. Its Inside has a flat conoidal Surface, where it is contiguous to the preceding Bone.

The fifth Metatarsal Bone is somewhat rough at its Basis and is transversely broader, than it is thick or high, being very oblique, and terminating by a Tuberosity and Point, which lies at a great Distance from the Plane of its Basis. The Tuberosity is externally, and the Margin quite posteriorly. The principal Side is oblique, answering to that of the Portion of the anterior articular Side of the Os Cuboïdes.

There is likewise an internal lateral Surface, articulated with the Basis of the fourth Bone, the posterior Part of the Bone expanded proportionably to the Basis, so that this Bone is obliquely

pyramidal; and the Tuberosity reaches the Ground, in the natural Situation of the Foot.

When we stand, the anterior Ends of these metatarsal Bones and the Os Calcis are our only Supporters, and therefore it is necessary they should be strong, and have such a confined Motion as they have.

The Bones of the Toes are much akin to those of the Thumb and Fingers; particularly the two of the great Toe are precisely formed as the two last of the Thumb; only their Position, in respect of the other Toes, is not oblique, and they are proportionally much stronger, because they are subject to a greater Force; for on those, principally, the Weight of the Body is supported, when we are raised on our Tip-Toes.

The three Bones, in each of the other four Toes, differ from those of the Fingers, in these Particulars. They are less, and smaller in Proportion to their Length: Their Bases are much larger than their anterior Ends: Their Bodies are sharper above and below, and flatter on the Sides.

The first Phalanx is proportionally much longer than the Bones of the Second and Third, which are very short.

Of the Four, the Toe next to the great one, has the largest Bones in all Dimensions, and more externally the Toes are less. The little Toe, and frequently that next to it, have the second and third Bones, intimately united into one, which may be owing to their little Motion, and the great Pressure they are subjected to.

The Toes are very useful to us in Walking; for when the Sole is raised, they bring our Body, with its Center of Gravity perpendicular to the advanced Foot.

The

The Bones of the Metatarsus and Toes are in the same Condition in Children, as those of the Metacarpus and Fingers.

The only Bones now remaining to complete the Description of the Skeleton, are the small ones, which are found at the Joints of the Fingers and Toes, and in some other Parts, called *Ossa Sefamoidea*, which are very different Figures and Sizes, though they are generally said to resemble the Seed of the Sefamum.

They seem to me nothing else than the Ligaments of the Articulations, or the firm Tendons of strong Muscles, or both become osseous; by the violent Compression which they suffer. Thus the sesamoid Bones at the Beginning of the Gastrocnemii Muscles are evidently composed of the tendinous Fibres only.

These, at the first Joint of the Great Toe, are as plainly the same continued Substance, with the Ligaments and Tendons of the Abductor, Flexor brevis, and Adductor.

That, which is sometimes double at the second Joint of the Toe, is Part of the circular Ligament; and if we enumerate the other sesamoid Bones, that are at any Time found, we may observe all of them formed in the same Manner. Their Number, Figure, Situation, and Magnitude, are so uncertain that it were in vain to insist on the Differences of each: 1st, That whenever the Tendons and Ligament are firmest, the Actions of the Muscles strongest, and Compression greatest, there such Bones will be most probably found. 2dly, That, *cæteris paribus*, the older the Subject is in which they are sought, their Number will be greater, and their Size bigger. 3dly, The more Labour in either, or both Extremities, that any Person is injured to, he will, *cæteris paribus*, have the most numerous and largest *Ossa Sefamoidea*.

However, as the two, at the first Joint of the great Toe, are much larger than any other, and are seldom wanting in an Adult, we may judge, that, besides the more forcible Course of their Formation, there should also be some particular Advantage necessary at this Place, rather than elsewhere, which may possibly be allowed to the Flexor Muscles, to send their Tendons along this Joint, secure from Compressions in the Hollow between the two oblong Sefamoïd Bones; while, by removing these Tendons from the Center of Motion, and giving them the Advantage of the Angle at their Insertion, the Force of Muscles is increased, and therefore the great super-incumbent Weight of our Body, in Progression, is more easily raised.

MONROE'S Anatomy of the Bones.







## LECTURE XII.

### The CARTILAGES and LIGAMENTS of the SUPERIOR EXTREMITY.

**N**O Part of the Os Femoris is covered with Cartilage, except the uniform Convexity of its Head and the articular Portion of the uniform Extremity. The Trochanters have no true Cartilage, what looks like it being only the Remains of tendinous Insertions, as has been observed already of the Crista of the Os Ilium. The cartilaginous Substance, which, to a certain Age, unites the Epiphyses to the Body of the Bone, does not belong to this Place, because it is only formed in time of Youth, and in Adults is converted into Bone.

The cartilaginous Substance, by which the Head of the Os Femur is cemented, deserves, however, to be observed, because that Epiphysis has been separated by violent Falls.

The Convexity of that Head, all the way to its Symphysis with the Cervix, is covered by a very smooth shining Cartilage. We have already remarked in the Osteography, that a little below the Convexity, and something toward the posterior Part, there is a Depression in the Form of a Crescent; the Cartilage being there interrupted by the Insertion

## 234 Cartilages and Ligaments. Lect. XII.

tion of the articular Ligament of the Head of the Femur.

The Cartilage which covers the inferior Extremity of this Bone, is exactly fitted to the femi-oval Convexity of the inferior Surface of each Condyle, and to the Trochlea formed by their Union.

In the posterior Part of the lateral Tuberosity of each Condyle, there is another kind of cartilaginous Surface.

### LIGAMENTS OF THE OS FEMORIS.

The Femur is connected by its superior Extremity to the Ilium, and by the inferior, to the Bones of the Leg, by means of several Ligaments. The Ligaments of the superior Extremity are two; One, which surrounds the whole Articulation thereof, with the cotyloid Cavity, and one contained in the Articulation.

The first is termed the orbicular Ligament of the Head of the Femur; the other, the internal Ligament. To these we may (though very improperly) add a Third, which is of the Nature of a capsular Ligament, as we shall describe.

The orbicular Ligament is the most considerable, largest, and strongest of all the articular Ligaments of the human Body. It is fixed quite round the Margin of the cotyloid Cavity; and from thence largely surround the whole Head, and superior Portion of the Cervix of the Femur, and is closely inserted inferiorly to the Cervix, that is, between its Basis, and middle narrow Part.

This Ligament is composed of several sorts of Fibres; the chief of which are longitudinal and oblique, and it is much thicker and stronger in some Parts than in others. It is very thick between the anterior inferior Spine of the Ilium, all  
the

## Lect. XII. Cartilages and Ligaments. 235

the way to the small anterior Tuberosity, which unites, as it were, the Basis of the Trochanter major with the Basis of the Cervix.

It is likewise very thick, between the same Spine, and the Middle of the oblique Linea Aspera, observable between the Tuberosity and the minor Trochanter; and here likewise it is strengthened by a Bundle of Fibres, connected to the Passage of the Tendon of the Iliac Muscle, and to the inferior Portion of the oblique Linea Aspera. The Disposition of the ligamentary Fibres, of which these two thick Portions are composed, form a sort of Triangle, with the oblique rough Line, which terminates the Basis of the Cervix.

At the posterior and superior Part of this Ligament, there is another thick Portion formed by oblique Fibres, one End of which is fixed between the inferior Margin of the cotyloid Cavity, and the Passage of the Tendon of the external obturator Muscle; the other to the superior Part of the small Tuberosity of the Trochanter major, already mentioned.

The posterior and inferior Parts of it are thinner and shorter than the rest; but even this is strengthened by a Fasciculus of pretty strong Fibres, which, from the whole Crista of the Pubis, decends obliquely anteriorly, near the cotyloid Scissure, and is fixed superiorly to the Basis of the Cervix of the Femur, immediately above the small anterior Tuberosity of the Trochanter major.

The other Ligament of the Head of the Os Femoris, which WINSLOW names internal, resembles a flat Cord, being composed of a Bundle of Fibres compactly interwoven. One End of it is in a manner divided into two flat Membranes, inserted, one at each Corner of the cotyloid Scissure, in the manner already explained. It might likewise

## 236 Cartilages and Ligaments. Lect. XII.

wise be called the inter-articular Ligament of the Head of the Os Femoris.

From this Insertion, it descends obliquely, and a little ascends, between the cotyloid Gland, and the cartilaginous Convexity of the Head of the Femur, and terminates superiorly to the small femi-lunar Fossula, which may be reckoned the Pole of that Convexity. This Insertion is obliquely, a little rounded superiorly, and flat inferiorly, and, in some Subjects, there is a sort of Depression in the Head of the Bone for the Passage of the Ligament.

The Ligaments of the inferior Extremity of the Femur, by which this Bone is connected with those of the Leg, are six in Number, one posterior, two lateral, two middle or crucial, and one capsular.

The crucial Ligaments lie within the Articulation, and are fixed by one Extremity to the Scissure, or Opening, which parts the two Condyles; they are surrounded by the capsular Ligament, but all the rest lie externally thereof, being closely joined to it.

Of the two lateral Ligaments, one is internal and broad, being fixed to the Tuberosity of the internal Condyle. The other is external and narrow, fixed to the Tuberosity of the external Condyle.

The posterior Ligament is broad and thin, being fixed a little above the Convexity of the external Condyle, from whence it descends obliquely behind the great Scissure, and internal Condyle.

The capsular Ligament, glued, as it were, to the three former, as has been said, is fixed quite round the inferior Extremity of the Femur, at a small Distance above the anterior, lateral, and posterior Parts of the Cartilage, and above the posterior of the great Scissure, through the small Space superiorly, already mentioned, it covers the Bone; and afterwards is inverted inferiorly to form the Capsula,  
for

## Lect. XII. Cartilages and Ligaments. 237

for the mucilaginous Liquor of the Articulation. The rest of the Description of all these Ligaments, must be referred to that of the Bones of the Leg.

The Marrow of the Femur lies in a large Mass, in the middle Cavity of the Bone, and in small distinct Clusters, in the Cells of each Extremity. The first is penetrated at different Distances, by the osseous Filaments, or Ramifications of the reticular Texture, and thereby sustained in violent Motions and Shocks, as in Leaping, Running, &c.

### CARTILAGES OF THE BONES OF THE LEG.

The Tibia has four or five proper Cartilages, and two Additional.

The two proper Cartilages, which cover the two superior Surfaces of the Head of the Tibia, are the thickest. They are both a little convexive, but the internal, or that next the other Tibia, is more depressed in the Middle than the other. The posterior Part of the external is insensibly depressed, and thereby a Sort of Convixity is formed. Anteriorly, they connect each other, posteriorly; they are parted by a slight Scissure; in the Middle they are separated by the articular Tuberosity of the Head of the Tibia, which is likewise partly covered by them on each Side.

The third proper Cartilage covers the small Surface, which lies on the inferior Part of the external Condyle.

The fourth covers the inferior Surface of the Basis of the Tibia, being continued over externally of the internal Ankle.

There are likewise superficial cartilaginous Incrustations, posteriorly, of this Basis behind the internal Ankle, and likewise on the posterior of the external Ankle, all for the Passage of Tendons.

## 238 Cartilages and Ligaments. Lect. XII.

The additional Cartilages of the Tibia, are two in Number called Semi-lunar from their Figure, and inter-mediate, or inter-articular from their Situation.

Each of these Cartilages is in the Figure of a Crescent, or Roman C. Their Convexity, or greatest Curvature is very thick; their Concavity, or smallest Curvature, very thin, something like the Edge of a Sickle. They lie on the two superior Surfaces of the Head of the Tibia; their thickest Part, or Convexity, answering to the Margins of the Head, and their thin acute, to the Middle of each Surface, their Extremities, or Cornua, being turned toward each other.

Each Cartilage is sufficiently broad to cover about two Thirds of the Surface of the Tibia, on which it lies, leaving one Third bare in the Middle. Their under Sides are flat; the superior Sides concave, and, together with the middle Portions of the Surfaces of the Head of the Tibia, form Cavities proportionable to the Convexity of the Condyles of the Femur.

The Fibula has two Cartilages; one lying on the superior Extremity of that Bone, for its Articulation with the small cartilaginous Surface in the Head of the Tibia. The other Cartilage lines the Inside of the inferior Extremity, or of the external Malleolus; near the Point of which, posteriorly, there is a superficial cartilaginous Incrustation, for the Passage of the Tendons of the Musculi Peronæi. The Cartilage, at the superior Extremity of the Fibula, seems to be thicker than that at the inferior Extremity.

The Patella, which belongs properly to the Tibia, and not to the Os Femoris, has a pretty thick Cartilage on its posterior or articular Side, divided, by a superficial longitudinal Rising, into two Parts, proportioned to the two Portions of the Trochlea  
of

of the Femur, as has been observed in the Description of the Bones.

LIGAMENTS OF THE BONES OF THE LEG.

I have observed, that the Tibia is connected with the Os Femoris, by several Ligaments; two lateral, one posterior, two middle, and one capsular; and I have shewn in what manner they are fixed in the inferior Extremity of the Os Femoris: Their Insertions in the Bones are as follow.

The interior and broadest of the two lateral Ligaments is fixed somewhat inferiorly on the internal Surface of the superior Part of the Tibia, between the Beginning of the Crista, or anterior Angle, which is turned toward the other Tibia. It is likewise connected to the Margin of the internal Semi-lunar or inter-articular Cartilage.

The external lateral Ligament, which is narrow and thicker than the former, is fixed partly in the Tibia, immediately above the Fibula, and partly in the superior Extremity of the Fibula; and connected likewise to the Margin of the external semi-lunar Cartilage. Both these Ligaments lie a little behind the Middle of the Articulation.

The posterior Ligament is fixed by several Expansions, in the posterior Part of the Head of the Tibia.

One of the crucial Ligaments is fixed by one End to the internal superficial Impression in the Scissure of the Os Femoris; and by the other, to the Scissure in the Head of the Tibia, behind the cartilaginous Tubercle, which lies between the two superior Surfaces.

The other crucial Ligament is fixed by one Extremity to the external Impression in the Scissure of the Femur; and by the other, between the anterior

terior Portions of the Surfaces just mentioned, before the cartilaginous Tubercle.

These two Ligaments are composed of several Series of Fibres. The first (which is internal in respect to the Femur, and posterior in respect of the Tibia) is broader and stronger than the other, which is external in regard of the Os Femoris, and anterior to the Tibia.

The Semi-lunar Cartilages have likewise particular Ligaments, besides their Connexions with the lateral Ligaments of the Tibia. Their Cornua, in some measure, degenerate into short strong Ligaments, by which they are fastened to the cartilaginous Tubercle, between the two superior Surfaces of the Tibia, and likewise communicate, by some Portions, with the crucial Ligaments.

They have likewise a common Ligament, which, like an Arch, runs transversely between the anterior Convexity of the one to that of the other.

These Cartilages, therefore, have three Sorts of Connexions. They are fixed to the Tibia, by the Ligaments of the Cornua; to each other, by the transverse Ligament; and to the Femur, by their Communications with the crucial Ligaments; and by their Adhesions, to the lateral and capsular Ligaments. The Patella is fastened to the Tuberosity or Spine of the Tibia, by a broad and very strong Ligament, which descends directly from the Apex of the Patella, and is oftentimes strengthened by some Fibres of a considerable Tendon, inserted in the superior Part of that Bone.

It has likewise small lateral Ligaments fixed in the inferior Part of its Margin on each Side, which parting gradually from the great Ligament as they descend, are inserted anteriorly, and a little laterally in the Margin of the Head of the Tibia.

The capsular Ligament of this Articulation, of which I described one Part in speaking of the  
inferior



## Lect. XII. Cartilages and Ligaments. 241

inferior Extremity of the Femur, is fixed round the Margin of the Head of the Tibia, and in the Margin of the Patella; so that the Patella itself forms a Portion of the mucilaginous Capsula of the Joint of the Knee.

The crucial Ligaments, and those of the femi-lunar Cartilages, are included within the Capsula; but the lateral and posterior Ligaments, and those of the Patella, lie without it, being closely connected to its external Surface.

This Capsula is likewise connected to a considerable Portion of the Circumference of the Semi-lunar Cartilages, and it is also corroborated at different Distances, by several distinct Series of ligamentary Fibres, more or less thick. The Inside of it is smooth; and shining and very thin, where it is not covered by Tendons, as shall be observed hereafter. It not only contains and surrounds the Ligaments already named, but likewise furnishes them with a very fine Vagina.

There is likewise a very thin Ligament, fixed by one Extremity to the inferior cartilaginous Side of the Patella; and by the other, to the anterior Part of the great Scissure, between the Condyles of the Femur; the Use of which seems to be to prevent the articular Fat from being compressed in the Motions of the Knee.

The Fibula is connected to the Tibia, by nine Ligaments; four at each Extremity, and one in the middle, called the inter-osseous Ligament.

The Ligaments at the superior Extremity of the Fibula, are short, very strong, more or less oblique, and compound. Two of them are anterior, two posterior, and they lie on each other; the superior Ligaments surrounding the Articulation more closely than the inferior, which leave a small void Space, and are weaker than the former. They are all coagulated to the capsular Ligament, which

## 242 Cartilages and Ligaments. Lect. xii.

runs in between them and the Articulation; and they are inserted round the Margin of the cartilaginous Surfaces in each Bone.

The Ligaments of the inferior Extremity of the Fibula, which run below the Tibia, and form the external Malleolus, are much stronger, thicker, more complex, broader, longer, and more oblique, than those of the superior Extremity; and are disposed much after the same Manner; that is, two before, and two behind.

They are fixed to the anterior and posterior Margins of the lateral Depression, at the inferior Extremity of the Tibia; and from thence they descend on the inferior Extremity of the Fibula. The two inferior Ligaments are largest, and fixed anteriorly and posteriorly at the inferior Extremity of the external Malleolus. The two superior are fixed more compactly and nearer each other, but there still remains a small Space between them, filled with Fat.

As the two Bones touch each other only by the superior Part of the cartilaginous Surface of the external Malleolus, and the small cartilaginous Borders in the inferior Margin of the Depression of the Tibia, the middle Space between them is filled by a sort of capsular Ligament, which lines each Side of the Bones, and is continued down to the true Articulation of the external Malleolus, with the inferior Margin of the Basis of the Tibia.

The middle or inter-osseous Ligament of the two Bones of the Leg, so called, from its Situation between them, being stretched from one to the other, is fixed along the posterior external Angle of the Tibia and the adjacent Angle of the Fibula.

At the inferior Part of each Ankle, there are commonly three strong Ligaments for the Connexion of the Bones of the Tarsus with those of the Leg;

Leg;

## Lect. XII. Cartilages and Ligaments. 243

Leg; one that advances, one that descends posteriorly, and one that runs more or less directly inferiorly; all of them being fixed in the Places, which shall be described.

There are some other ligamentary Expansions belonging to the Bones of the Leg; but as they do not serve so much for the Connexion of the Bones, as to support the Muscles, the Description of them, as well as the annular Ligaments, will more naturally come in, in the Treatise of the Muscles.

### MARROW AND MUCILAGINOUS GLANDS OF THE BONES OF THE LEG.

The MARROW of these Bones lies in large Masses in the great Cavities, and in distinct Moleculæ in the spongy Parts, as has been already observed in general.

The mucilaginous Glands lie in the small Spaces, Depressions, and superficial Scissures near the Margins of the Cartilages of each Joint. They are covered by the capsular Ligaments, and more or less mixed with a fatty Substance.

The Glands of the Knee, which lie near the Margins of the Patella, are the most considerable, being disposed in form of Fringes, and supported by a great Quantity of fatty Matter, which makes, in some measure, one Mass with them.

This common Mass is contained within the capsular Ligament, and on the Side of the Joint is covered by a very fine Membrane, which likewise lines the interior Surface of the Ligament. The glandulous Substance is easily distinguished from the Foot, by the reddish Colour of the capillary Vessels, which surrounds them.

The superior Portion of this Mass, is, as it were, suspended by the small Ligament, fixed anteriorly of the great common Scissure of the Condyles of

## 244 Cartilages and Ligaments. Lect. XII.

the Femur; and which from thence ascends superiorly to the Patella, as has been already observed in the Description of the Ligaments.

There are other mucilaginous Glands, both above and below, the Margin of the semi-lunar Cartilages.

And likewise in the Femur, some whereof serve for the Articulation of the rest, for the crucial Ligaments. These last lie in Folds, formed by the internal Membrane of the capsular Ligament, which give particular Coverings to the circular Ligaments, and to the other Fasciculi of the ligamentary Fibres near them.

### CARTILAGES OF THE BONES OF THE FOOT.

The Astragalus is covered by three Cartilages: The first covers the three Surfaces, which makes the Convexity and Sides of the Trochlea; the second, the concave Surface of its anterior Part, so far as to form three other small Surfaces, one of which is not articular in a strict Sense.

The first of these Cartilages is for the Articulation of this Bone with the Tibia and Fibula; the Second, for the Os Calcis; and the Third, for the Os Scaphoides.

Two of the inferior Surfaces, formed by the Continuation of the third Cartilage, are for the Articulation of this Bone, with the Os Calcis; the Third contributes to the Formation of a Canal for the Passage of a Tendon.

The Os Calcis has four Cartilages; of which three are superior, one large, and two small; for its triple Articulation with the Astragalus; the fourth is anterior, for the Os Cuboides. To these must be added, a small thin Cartilage, of a kind of ligamentary Substance, under the Tubercle, on the external Side of this Bone.

The

## Lect. xii. Cartilages and Ligaments. 245

The Os Scaphoïdes, has two remarkable Cartilages : One posterior, for its Articulation with the Os Calcis; and one anterior, lying in two Planes, for its Articulation with the two last last metacarpal Bones. It has likewise a Cartilage on the Inside for the Os Cuneiforme, which is next to it, and one inferiorly, covering a Part of the oblique Eminence situated there.

The three Offa Cuneiformia have each of them a posterior Cartilage, for their Articulation with the Os Scaphoïdes; and one anterior, for the three first metatarsal Bones. They have likewise small cartilaginous Surfaces on their lateral Sides, for their Articulations with each other; and besides, the first and third Bones are connected thereby to the lateral Parts of the Basis of the second metatarsal Bone; and the third, to the Os Cuboïdes.

The Bases and Heads of the metatarsal Bones are covered with Cartilages.

The Phalanges have Cartilages in the same manner at their Bases and Heads, except at the Heads or Extremities of the last.

The sesamoïd Bones are covered with Cartilages on that Side, by which they slide on other Bones.

We ought to beware of confounding the Remains of Tendons, Ligaments, and Aponeuroses, with the true Cartilages; as for Instance, at the posterior Part of the Os Calcis; I gave the same Caution when I spoke of the Cartilages in general.

### LIGAMENTS OF THE BONES OF THE FOOT.

The Foot, being composed of several Bones, must, besides those Ligaments, by which it is tied to the Leg, have several others to connect, not only the three Parts of which it is composed, but also

## 246 Cartilages and Ligaments. Lect. XII.

the particular Bones belonging to each Part. We have already mentioned the Insertions of three Ligaments in each Ankle.

The Ligaments of the internal Malleolus, are all fixed in the Inside of the Astragalus. The most anterior is pretty broad, and sometime seems to be connected in one, with the middle Ligament. It often consists of several distinct Parts, like so many Membranes interlarded with Fat.

The anterior and middle Ligaments, of the external Malleolus, being more or less broad, are fixed exteriorly, to the Astragalus; the posterior, which is narrowest, and pretty thick, is chiefly fixed in the external of the great Portion of the Os Calcis.

All these Ligaments lie externally on the Surface of the Capsula, which surrounds the Articulation of the Astragalus with the Bones of the Leg.

The Ligaments, by which the Bones of the Tarsus are connected with each other, are short, flat, of different Breadths, and run from one Bone to another in various Directions. They are all superficial, except one, by which the Astragalus is tied to the Os Calcis, and for the most Part, are either superior or inferior, the lateral Ligaments being but very few in Number.

Some of them are partly common to several Bones, and partly belong only to two; the superficial Strata of their Fibres, run over one Bone into the following, and sometimes further; but the Strata next the Articulation, are generally confined to two Bones only.

The Astragalus is tied to the other Bones of the Tarsus, by several true Ligaments, viz.

To the Inside of the Os Calcis, by a Ligament, which comes from the posterior internal Tuberosity of the Body of the Astragalus, and is fixed  
in

## Lect. XII. Cartilages and Ligaments. 247

in an Inequality behind the lateral Apophysis of the Os Calcis.

To the interior Surface of the same Bone, by a Ligament, which comes from the lateral Apophysis of the Os Calcis, and is fixed in a sort of cartilaginous Production internally to the Cervix of the Astragalus.

To the external Surface of the same Bone, by two Ligaments, which form the Margin of the oblique inferior Depression of the Astragalus, and afterwards separating a little, are fixed in the external Surface of the great Apophysis of the Os Calcis; one anteriorly, which seems to send off a small Portion to the Os Cuboides, the other posteriorly of different Breadths.

To the Os Scaphoides superiorly, by a Ligament which goes from the Cervix of the Astragalus to the superior Part of the Os Scaphoides, and from thence is extended to the Middle of the Os Cuneiforme.

To the same Bone interiorly, by two Ligaments, one of which is a Continuation, of that which goes from the lateral Apophysis of the Os Calcis, to the cartilaginous Production of the Astragalus; the other is near the same Production, being partly covered by the former, and fixed in the Tuberosity of the Os Scaphoides.

To the Os Calcis, by a Ligament which comes from the oblique inferior Depression of the Astragalus, and is fixed in the oblique superior Depression of the Os Calcis.

If to these principal Ligaments of the Astragalus, we add several less remarkable, and also those by which it is tied to the Ankles, their Numbers will be very considerable.

The capsular Ligaments go very little further than the Margins of the Articulations of this Bone with the rest. They adhere very closely to

## 248 Cartilages and Ligaments. Lect. XII.

the true Ligaments, and are covered and lined by them.

The Os Calcis is joined to the external Malleolus and Astragalus by the Ligaments already described. It is likewise connected to the Offa Scaphoïdes and Cuboïdes by several ligamentary Planes. It is connected to the Os Scaphoïdes, 1st, by a Continuation of the Ligament that goes from its lateral or internal Apophysis to the cartilaginous Production of the Astragalus. 2dly, By a ligamentary Lamina, which goes from the inferior Tuberosity of its great Tuberosity of its great Apophysis, and is fixed in the inferior Part of the Circumference of the Os Scaphoïdes. 3dly; By a narrow Ligament which goes from the superior and internal Part of the same Apophysis, and ends in the nearest Part of the Circumference of the Os Scaphoïdes.

It is connected to the Os Cuboïdes, first, by a Ligament, or rather by several ligamentary Fasciculi, which go from the Extremity of its oblique superior Depression to the contiguous Angle of the Os Cuboïdes. Secondly, by one lying between the first, and the small external lateral Tuberosity of the Os Calcis, and inserted in the Os Cuboïdes near the first. Thirdly, by one which is fixed to the exterior and inferior Part of the great Apophysis of the Os Calcis, and to the contiguous Part of the Os Cuboïdes. Fourthly, by a pretty broad Lamina, which covers the inferior Part of the Os Calcis; and which, from the anterior Tuberosity of this Part, spreads over the contiguous inferior Part of the Os Cuboïdes, and terminates in the oblique Eminence of that Bone. Fifthly, by a broader Lamina, which, having filled the inferior Part of the lateral Concavity of the Os Calcis, is chiefly inserted in the contiguous Angle of the Os Cuboïdes.

The



## LECT. XII. Cartilages and Ligaments. 253

The capsular Ligaments agree with those of the Astragalus.

The Os Scaphoïdes is tied to the Astragalus and Os Calcis in the Manner already said.

It is likewise connected to the Os Cuboïdes, and the Offa Cuneiformia, by several Ligaments on the external Surface, or that next the Os Cuboïdes; there is one which connects it to the contiguous Angle of that Bone. On its superior Part, two go from its Circumference, one to the second, the other to the third Cuneiforme. On its anterior Side, it is joined to the convex Side of the great Os Cuneiforme by two Ligaments. On its lower Side it has four; whereof the first appears as if it were double, going from the Tuberosity of this to the Basis of the first Os Cuneiforme; the second and third go obliquely to the other two Offa Cuneiformia; the fourth is a little transverse, being fixed in the inferior internal Angle of the Os Cuboïdes.

The Os Cuboïdes, besides the Ligaments which tie it to the Astragalus, Os Calcis, and Os Scaphoïdes, already mentioned, has others which connect it above, below, and on the external Side, with the third Os Cuneiforme, and two last Bones of the Metatarsus. The superior Ligaments are almost equally flat, the inferior unequally thick, and stronger than the superior. The exterior goes from the Os Cuboïdes to the Tuberosity in the Basis of the last Bone of the Metatarsus, and seems likewise to communicate with the third Bone by some ligamentary Fibres.

The three Offa Cuneiformia are fixed to the Os Scaphoïdes, by the Ligaments abovementioned. They are connected superiorly by particular ligamentary Laminæ, which go more or less transversely from one Bone to another; being all joined to one common ligamentary Lamina, which covers

covers these three Bones, and also the Os Cuboides. Inferiorly, they are connected by stronger and thicker Ligaments. They are likewise connected by Ligaments to the three first Bones of the Metatarsus.

The greatest Os Cuneiforme is joined on its superior, inferior, and interior or convex Side to the Basis of the first metatarsal Bone, by ligamentary Fibres, which form almost a continued Lamina; the inferior Part of which is strong and thick, and appears to be double. It is likewise tied interiorly to the Basis of the second metatarsal Bone, by a particular Ligament.

It has likewise exteriorly, on its inferior Part, three considerable Ligaments, more or less oblique; the first and shortest of which goes to the Basis of the second metatarsal Bone, the second to that of the third, and the third to that of the fourth.

The Bones of the Metatarsus are connected by their Bases and Heads. The Ligaments that go between the Bases are superior and inferior. The superior are flat and small; the inferior strong and thick, and, as it were, multiplied by entering the Interstices between the Bases.

The Ligaments, which go between the Heads, have nearly the same Disposition. The inferior have this peculiar to them, that by filling the Spaces between the Heads, they keep them at some Distance from each other. The inferior Portions of these Ligaments are fixed in the Angles, at the lower Part of each Head. They are moreover corroborated by their Union and Intertexture with the Aponeurosis Plantaris.

The first Phalanges of the Toes are tied to the Heads of the metatarsal Bones, by a Sort of orbicular Ligament, set round the Margins of the cartilaginous

## Lect. XII. Cartilages and Ligaments. 251

cartilaginous Portions of the Head, and those of the Bases of the Phalanges.

In the four Toes, next the great Toe, the inferior Part of these Ligaments is very thick, and crusted over, as it were, with a cartilaginous Substance, fixed to the Basis of the Phalanges, and from thence continued over the Head of the metatarsal Bone next it. This Substance grows hard with Age, like a sesamoid Bone.

Of these Sesamoids, the great Toe has two belonging to the first Phalanx; which are the largest, the first formed, and most considerable of all that go by that Name. They are shaped like an Olive, being about one third Part of an Inch in Length, and about half as broad as long.

They are connected by their anterior Extremities to the Basis of this Phalanx, close by each other, and lie in the two Depressions inferiorly, to the Head of the first metatarsal Bone.

The second and third Phalanges of all the Toes, being articulated by the Ginglymi, have lateral Ligaments, which go between the Sides of the Heads; at the inferior Margins of all these Bases, there is a cartilaginous Matter, connected to the Ligaments, which hardens with Age, in the same Manner as those of the first Phalanges.

The capsular Ligaments of all these Articulations are disposed in the same Manner as in the first Bones of the Tarsus already described.

The annular Ligaments and ligamentary Vaginae found on the Surface of many of these Bones, contribute nothing to their Connection, and therefore shall be explained in another Place.

The Periostium, which covers all these Bones, is of the same Kind with that of the Bones of the Leg.

The Marrow is suitable to their internal Structure, that is in Moleculæ, in the cavernous Portions,

tions, and in Masses; in those which have large Cavities. Thus the Marrow of all the tarsal Bones is disposed in *Moleculæ*, because their internal Structure is spongy. In the metatarsal Bones, and first Phalanges of the Toes, it is disposed in the same Manner, as in the Tibia and the Fibula; that is, it lies in *Moleculæ*, in the Extremities; the Structure of which is cavernous, but in the middle Portions of them, it lies in Masses, greater, or less, according to the Size of the Cavities.

In the other Phalanges which are entirely spongy, it is accordingly disposed in *Moleculæ*.

The mucilaginous Glands answer, in Number and Figure, to the Depressions between the cartilaginous Margins and Ligaments.

## MECHANISM AND USE OF ALL THE BONES OF THE INFERIOR EX- TREMITIES.

The Articulation of the *Os Femoris* with the *Os Innominatum*, being by *Enarthrosis*, that is, the spherical Head of the Thigh-Bone, being lodged in the *Acetabulum*, the Thigh is disposed to be moved on all Directions. We can carry it forward and backward, nearer the other Thigh, or to a greater Distance from it; and these four Motions may be rendered more or less oblique, and thus the Number of them may be multiplied, according to the different Degrees of Obliquity.

All these Motions may likewise be combined in such a Manner, as that the inferior Extremity of the Bone shall describe a sort of Circumference, while the Head moves round a Center.

The

The Os Femoris may also have another kind of Motion ; called by Anatomists Rotation ; though very improperly. By this Motion, they understand two reciprocal half Turns that are, in opposite Direction to each other ; which the Thigh is capable of making round an Axis ; but it is very evident, if we consider the Obliquity of the Cervix, that this Motion is not round the Axis of the Bone, but round a Line from the Head, to the Middle of the Pulley at the lower Extremity, when the Subject is supposed to be standing.

We are likewise to observe, that by this Rotation of the Os Femoris, the Cervix and great Trochanter are moved simply posteriorly and anteriorly ; whereas, when the Bone is moved directly forward or backward, the Cervix moves more or less round its Axis ; especially if, at the same time, the Bone be held at some Distance from the other.

All the Motions of the Os Femoris are differently limited by the Structure of its Articulation ; and especially by that of the Acetabulum : And likewise pretty much by the Situation of the Head on the superior Extremity of the Bone. In a word, the Depth and Obliquity of this Articulation render the Mechanism thereof very particular ; and it is of the greatest Consequence to be well acquainted with it, in Cases of Luxations and Fractures.

The following Observations will be sufficient to give a true Idea of it.

The Thigh ought to support firmly the Weight of the whole Body, when we stand or kneel ; and that in all the different Attitudes, or Changes of Situation, that is, whether the Trunk be strait, inclined, or turned, and even with the Addition of a considerable Load.

The Thigh is moveable in all Directions, but the Motion of Flexion is the greatest of all, whether we stand, or sit, that of Adduction is likewise  
con-

considerable; especially when the Thigh is bent. These two Motions are more frequent, as well as of a greater Extent, than the rest; for it is chiefly by them that the Body is carried from one Place to another, and also put in several ordinary and necessary Situations, whether standing, sitting, or lying.

These two general Dispositions are founded on the Depth and Obliquity of the Articulation. By the first, the Thigh becomes able to support the Body in all the Attitudes already mentioned; and by the second, the principal Motions are made easy.

The Acetabulum, or cotyloïd Cavity is deeper on the superior and back Part, than on the inferior and fore Part: And it is at these two Places, or in the middle Space between them, that the Body is sustained, according as it is in an erect or inclined Posture. The Structure of the Head of the Os Femoris is exactly suited to these supporting Points in the Acetabulum; its cartilaginous Convexity being larger on the upper Part, than any where else. The Acetabulum is shallow on the fore and lower Parts, not only because these Parts are less necessary for supporting the Body, but also because a Provision is thus made for the Bones of the Obliquity of the Articulation; without which, the Thigh could not, without great Difficulty, have been bent, or carried inwards, or over the other Thigh. The Obliquity of the cotyloïd Cavity facilitates the Motion of the Adduction: and the Obliquity of the Head of the Os Femoris facilitates and enlarges the Motion of Flexion.

In the Motion of Adduction, Part of the Head of the Bone goes out of the Cavity; and that in two different ways. When we stand, or lie at full Length, and, in those Postures, separate the Thighs from each other, the Head goes out at the lower

Part of the Cavity ; but when we sit, or lie on our Backs, with the Thighs raised and separated, it goes out on the fore Part.

The Motion, called Rotation, varies according as the Thigh is extended, or bent. The Rotation of the Thigh, when extended, brings the Head of the Os Femoris, either forward or backward ; when the Head is carried backward, the Neck strikes against the posterior Margin of the Acetabulum, and a large Portion of the Head goes out at the anterior Part of the Cavity ; but when the Head is carried forward, a very small Portion of it goes out of the Cavity, because of the Depth of the Margin at the back Part : And the Cervix does not strike against the anterior Margin, which is very low. In the Rotation of the Thigh, when bent, the Head is brought upwards and downwards, and goes less out of the Cavity above, than below.

The Articulation of the Tibia with the Os Femoris, is of a very singular Nature. For the Flexion and Extension of the Tibia, it is a Ginglymus ; but there is something more in it still, by which the Leg becomes capable of having a Rotation, independent of that of the Thigh. This double Mechanism depends on the semilunar Cartilages ; and therefore must be referred to the Description of the fresh Bones. It will be sufficient, in this Place, to make that Motion be conceived ; which I term the Rotation of the Leg, when bent ; because in that Case only, it is possible ; and we see it evidently, when sitting and pressing the Heel against the Ground, we turn the Toes alternately outward and inward.

We then observe, that the whole Leg makes reciprocal half Turns independently of the Thigh ; and if, at the same Time, we put our Hand upon the Knee, and then grasp the Joint with our Fingers,

gers, we feel the Head of the Tibia to move, in the same Manner; while the Extremity of the Os Femoris remains at rest.

And if we examine attentively, we shall find that the Center of this Motion is rather in the inner Cavity of the Head of the Tibia, than in the middle Space between the two Cavities, for we feel distinctly, that the external Part of the Head of the Tibia moves backward and forward, while the internal turns almost wholly round its Axis; we may therefore distinguish three Sorts of Motion in this Joint; that of Flexion and Extention, the Rotation of the internal Part of the Head of the Tibia upon an Axis, and a kind of Arthrodial Motion of the external Part of the same Head.

I look upon the Patella, as a Piece belonging as really and particularly to the Tibia, as the Olecranium does to the Ulna; because it is of the same Uses, with respect to that Bone, as the Olecranium is to the other. They both serve to facilitate the Action of the extensor Muscles, by placing their Direction at a greater Distance from the Center of Motion of the Joint.

They both serve to defend the Tendons of these Muscles from the Compressions, Contusions, and Ruptures, which they would otherwise be subject to in great Efforts, did they pass over the sharp Margins of the Bones; and lastly, they secure these Tendons from the like Accidents, when the Joints strike against, or press upon, any hard Body; as when we lean on the Elbow, or kneel, or when the Elbow or Knee receive any external Injury from Blows.

The Difference between the Patella and Olecranium lies in this; that none is immoveable, making but one Piece with the Ulna. The other is immoveable, being a Piece distinct from the Tibia. The Immobility of the Olecranium strengthens  
and



and secures the Articulation of the Ulna with the Os Humeri, which is designed only for Flexion and Extension.

For the same reason the Patella would have been immoveable, had the Articulation of the Tibia with the Os Femoris been contrived for these two Motions alone, and especially because the extensor Muscles of the Tibia are very often exposed to greater Efforts, in supporting the Weight of almost the whole Body; sometimes increased by that of a considerable Burden.

The Rotation of the Leg, when bent; is the sole Cause of this Difference, because, had the Patella been immoveably joined to the Tibia, the Leg could never have made these half Turns, without either a Luxation or Fracture of the Patella. The Olecranon may therefore be looked upon as an immoveable Patella, and the Patella as a moveable Olecranon.

The Fibula is articulated by its superior Extremity with the inferior Surface of the external Condyl of the Head of the Tibia. This is an obscure Arthrodia, and suffers the Head of the Fibula only to slide a little anteriorly and posteriorly; the only Design in which small Degree of Motion seems to be that the Fibula, in which many Muscles of the Foot are inserted, may have liberty to yield a little in the violent Efforts of these Muscles; as in running much, jumping, or walking under a heavy Burden, as we shall see in the Exposition of the Muscles.

This Bone is likewise joined to the Tibia, by its inferior Extremity, and makes the outer Ankle: But this Connexion is chiefly ligamentary, as has been shewn in the Discription of the fresh Bones. The superior Margin of the cartilaginous Surface of this Extremity is articulated at the lower Part of the lateral Depression of the Tibia with a narrow car-

luginous Border, which is nothing but the thick Margin of the Cartilage at the Basis of that Bone.

The Extremities of these two Bones touch each other likewise a little by their osseous Portions, near the Cartilages. The Articulation, resulting from these two sorts of Connexion, has but a very small Extent, and seems to be partly a Synarthrosis, partly a Diarthrosis; that is a sort of Amphiarthrosis or double Articulation, almost without any Motion, except when it is necessary to make the center of Motion, of the superior Extremity of the Fibula. The cartilaginous Side of the external Ankle, or lower Extremity of the Fibula, completes the Cavity; by which the Leg is joined to the Foot, and contributes more to that than the internal Ankle.

The Crookedness frequently observed in the Fibula below the Middle, or at about two Thirds of its Length, does not seem to be natural; (because we sometimes meet with this Bone, perfectly strait) but to be rather owing to the Manner of depressing Children, this being the Place, at which they are swaddled very tight.

The Fibula is not situated directly on the Outside of the Tibia, but a little more backward; so that having placed the two Legs of a Skeleton in their natural erect Posture, a pretty thick Body might be passed between the two Tibiæ and Fibula without changing the Situation of the Legs.

The Foot is Articulated with the Leg by the Astragalus alone. This Articulation is a true angular Ginglymus, and confined intirely to the Motions of Flexion and Extension.

It is commonly thought, that two other Motions are likewise performed by means of this Articulation, viz. that of turning the Toes inward or outward, and that of the lateral Flexion of the Foot, or the turning the Sole of the Foot toward  
either

either Ankle, but neither of these Motions depend on the Articulation of the Foot, with the Leg; as the Structure of the Parts and just Observations evidently shew.

The Articulation of the Astragalus with the several Surfaces of the Os Calcis, is a kind of obscure Arthrodia as well as those of the other Bones of the Tarsus with each other. By these Articulations, the Foot not being supported, makes the small lateral Motions already mentioned: But when the Toes are turned outward or inward independent of the Tibia. The Os Calcis makes small semi Rotations under the Astragalus, and obliges the Os Scaphoïdes to slide in the same Direction with it on the anterior Side of the Astragalus, and this Motion of these two Bones is communicated to all the rest.

It is by the Articulation of the Os Scaphoïdes with the Astragalus, that the small lateral Flexions of the Foot are performed, viz. when the Sole of one Foot is turned toward the other Foot, or the contrary way: In this Case, the Os Scaphoïdes makes small Rotations on the anterior Side of the Astragalus, while the Os Cuboïdes slides up and down on the fore Side of the great Apophysis of the Os Calcis. The Obliquity of the articular Surfaces of these two Bones, is perfectly suitable to such a Motion, in these Motions the Os Calcis and Astragalus, are in a manner immoveable; but the other Bones are carried along with the Os Scaphoïdes.

The Articulation of the Os Scaphoïdes and Cuboïdes with the Offa Cuneiformia, that of the four last mentioned Bones with those of the Metatarsus, and that of the metatarsal Bones with each other, allow of an obscure Motion; by which we can bend or contract the Foot according to its

Length, and a little according to its Breadth likewise.

All these Motions of the Bones of the Tarsus and Metatarsus, are pretty sensible in Children; and the Loss of them is often owing to the Manner of wearing Shoes; which Loss is most frequent in the small Bones of the Tarsus, and those of the Metatarsus. Women's high heel'd Shoes change intirely the natural State of those Bones; causing in them the same sort of Disorder that we observe in the Vertebrae of crooked Persons. Those who do not wear strait Shoes, may preserve these Motions to a very advanced Age.

The Articulation of the first Phalanges of the Toes with those of the Metatarsus is spheroidal or orbicular, and allows Motion in different Directions. The Articulation of the Phalanges, with each other, is by a Ginglymus: In the natural State, these Motions are very free and easy, and they are impaired chiefly by the bad Manner of wearing Shoes, and it is for the same Reason that the Phalanges of the little Toe often grow together. The Articulation of the sesamoid Bones is a kind of Ginglymus, but the Explication thereof belongs to the History of the Muscles.





## LECTURE XIII.

## SARCOGRAPHY.

## Of the TEGUMENTS.



ALL the Parts of the human Body are invested by several common and universal Coverings, which Anatomists name Teguments.

There have been many Disputes about the Number of the Integuments. The Ancients reckoned five, viz. The Epidermis, Cutis, Membrana Adiposa, Panniculus Carnosus, and Membrana Musculorum Communis.

The first three of these Coverings are truly common or universal; that is, extended over all Parts of the Body; but, properly speaking, they ought to be reduced to two, for if we consider the Epidermis is rather a Part of an Epiphysis of the Skin, than a Tegument.

The two other Coverings mentioned by the Ancients are not universal; but confined to particular Parts of the Body.

The Cutis, or Skin, is a Substance of very large Extent, formed of several kinds of tendinous, membranous, reticular, and nervous Fibres, the Intertexture of which is so much the more won-

derful, as it is difficult to unfold; for their Directions are as various as those of the Stuff of which a Hat consists\*.

This Texture is what we commonly call Leather, and makes, as it were, the Body of the Skin. It is not easily torn, may be elongated in all Directions, afterwards recovers itself, as we see in fat Persons, in Women with Child, and Swellings; and it is thicker and more compact in some Places than in others.

Its Thickness and Compactness are not, however, always proportionable; for on the posterior Parts of the Body, it is thicker and more lax than the anterior Parts; and on the Palms of the Hands, and Soles of the Feet, it is both very thick and very solid. It is generally more difficult to be pierced by pointed Instruments in the Belly, than in the Back.

The external Surface of this Substance is furnished with small Eminencies, which Anatomists have thought fit to call Papillæ, in which the capillary Filaments of the cutaneous Nerves terminate by small radiated Pencils.

\* Anno 1657. In nosocomio nostro, præsentibus viris celeberrimis, Dom. JOANNE VAN HORNE, & Dom. FRANCISCO SYLVIO, medicinæ professoribus in illustri academiâ Lugduno batavâ, necnon Dom. GULIELMO PISONE, & Dom. FRANCISCO VANDER SCHAGEN, practicis Amstelodamensibus, vidimus juvenem quendam Hispanum, annorum 23; cujus nomen GEORGIUS ALBES, qui manu sinistra apprehendebat cutem humeri, mammæque dextræ, eamque ita extendebat, ut ori esset proxima; menti cutem utraqûe manu primò dacebat deorsum, instar barbæ, ad pectus ipsum, hinc sursum attollebat ad capitis verticem, sic ut oculum utrumque ea tegeret. Quamprimum removebat manum, cutis contrahebatur adeo, ut debitam lævitatem reciperet; ad eundem modum deorsum etiâ ducebat cutem genû dextrî, sursumve, ad ulnæ dimidiæ longitudinem, & hæc in locum naturalem facile iterum reducebat. Consideratione dignum erat, cutem eam quæ dictis locis, partes sinistras extendi nullo modo potuisse, firmissimè iis adhærentes. Causam cognoscere hætenus non licuit. JOBI à MEECKREN, Observat. Medico-Chirurgicæ. Cap. xxxii.

These Papillæ differ very much in Figure and Disposition, in the different Parts of the Body, and they may be distinguished into several Kinds.

The greatest Part of them is flat, of different Breadths, and separated by Sulci, which form a kind of irregular Lozenges. The pyramidal Figure ascribed to them is not natural, and appears only when they are contracted by Cold, by Diseases, by boiling or by some other artificial Preparation which alters their ordinary Structure.

The Papilla of the Palm of the Hand, of the Sole of the Foot, and the Fingers and Toes, are higher than on the other Parts of the Body; but they are likewise smaller, closely united together, and placed as it were endways, with respect to each other, in particular Rows, which represent on the Skin all kinds of Lines, streight, crooked, waving, spiral, &c: These several Lines are often distinctly visible in those Parts of the Palms of the Hand, which are next the first Phalanges of the Fingers.

The red Part of the Lips is made up of the Papillæ, representing very fine Hairs, or Villi closely united together.

There is another particular Kind under the Nails; the Papillæ being there more pointed, or in a manner, conical, and turned obliquely towards the Ends of the Fingers. Those which are found in the hairy Scalp, Serotum, &c. are still of the other Sorts.

The Papilla of the first and second Kinds appear to be surrounded at their Bases, by a soft mucilaginous and pretty viscid Substance, which fills the Interstices between them, and represents a kind of reticular Texture, the Foramina of which surround each Papilla. This Substance is commonly called Corpus Reticulare or Mucosum.

The Origin of this reticular, or mucous Body, has not hitherto been sufficiently explained, and it has not been determined, whether it forms an universal Integument, or whether it belongs more properly to the Skin, than to the Papillæ and Epidermis. This Mucous, coagulated and condensed by Air, and by Pressure after, being perforated with a Number of exhaling and inhaling Ducts, the Orifices of which are connected together by the interposed condensed Glue: Whether or no, we are not persuaded to this Opinion, by the mucous Expansion, upon the Membrane of Tympanum? To which add, the Dissolution of it in Water, observed by most eminent Anatomists; (which Experiment is by others denied in the Cuticula of Blacks.)

In Inflammations, we observe a reticular Texture of capillary Vessels, more or less extended on the Surface of the Skin; and curious Anatomists demonstrate the same thing, by fine Injections, which may be looked upon as artificial Inflammations. But neither of these Methods proves that in the natural State; these Vessels are sanguineous, that is, they contain the red globulus Blood.\*

It is more probable that this vascular Texture is only a Continuation or Production of the very small Capillaries of the Arteries and Veins, which, in the natural State, transmit only the serous Part of the Blood, while the red Part continues its

---

\* De Christo ipso, narrat Divus Lucas, quod "cùm esset in æstu contentius orans, sudore manebat simili sanguineis guttis ad terram delabentibus". Cap. XXII.

Hoc vulgò ita accipitur, uti ipso sanguine sudasset Servator mundi: id autem non dicitur; erat solummodo sudor ὡς ἐξ ἀφαιρέσεως αἵματος, sicut sanguinis guttæ; hoc est, guttæ sudoris adeò magnæ erant, crassæ, ac viscidæ, ut instar guttarum sanguinis caderint terram. Ita verba hæc intellexerunt JUSTINUS MARTYR, THEOPHYLACTUS, & EUTHYMIUS. Observavit tamen GALENUS, contingere interdum, poros e: multo aut fervido spiritu, usque adeò dilatarî, ut etiam exeat sanguinis per eos, fiatque sudor sanguineus. Vid. Lib. de Utilitate Respiratione, MEADEI Medica Sacra.



Course through wider Ramifications, which more properly retain the Name of Blood-veffels.

This vascular Texture is of various Forms and Figures in the different Parts of the Body. It is not the same in the Face, with what it is elfewhere, neither is it alike on all the Parts of the Face, as may be discovered by the most ordinary Microscopes: And from hence we might perhaps be enabled to give a Reason, why one Part of the Body turns red more easily than another.

The interior Surface of the Skin is covered by very small Tubercles called commonly cutaneous Glands, and they are likewise termed *Glandulæ Milares*, because of some Resemblance which they are supposed to bear to Millen-seeds.

These Tubercles are partly fixed in a small Fofula, in the Substance of the Skin, which answer to the same Number of small Cavities in the corpus Adiposum. Their excretory Ducts open on the external Surface of the Skin, sometimes in the Papillæ, and sometimes in one Side of them, as may be seen in the Ends of the Fingers, even without a Microscope.

The greatest Part of them furnishes Sweat, and others, a fatty, oily Matter of different Thickneses, as in the hairy Scalp; in the Back, behind the Ears, and at the lower Part of the Nose where this Matter may be squeezed out, in form of small Worms. On the Head, this is called the Dandriff, and Filth or Nastiness of the other Parts of the Body.

By macerating the Skin in Water, or in any other proper Liquor, these Corpuscles become more visible, especially in the Skin of the lower Part of the Nose, and of the Axilla. The late M. DUVERNAY demonstrated to the royal Academy, that the Structure of some of these cutaneous Glands resemble the Circumvolutions of small Intestines,

## 266 Of the Teguments. Lect. XIII.

testines, perfectly stored with capillary Vessels. The illustrious M. MORGAGNI Professor at *Padua* has given the Name of Glandulæ Sebaceæ, to those which furnish the unctuous Matter above mentioned.

Besides these Corpuscles, there are other small solid Bodies, almost of an oval Figure contained in the Substance of the Skin. These are the Roots or Bulbs, from whence the Hairs arise, and some of them are situated within the interior Surface of the Skin.

The Skin has several considerable Openings, some of which have particular Names; such as the Fissure of the Palpebræ, the Nare, the Mouth, the external Foramen of the Ears, the Anus and Apertures of the Parts of Generation.

Besides these, it is perforated by an infinite Number of small Holes called Pores, which are of two Kinds. Some are more or less perceivable by the naked Eye: Such as the Orifices of the milky Ducts of the Mamma, the Orifices of the excretory Canals of the cutaneous Glands, and the Passages of the Hairs\*.

The other Pores are imperceptible to the naked Eye, but visible through a Microscope; and their Existence is likewise proved by the cutaneous Trans-

\* LEEUWENHOECK, and others, say the Cuticula is scaly, and compute that a grain of Sand, of the hundredth part of an Inch Diameter, will cover two hundred of these Scales, and that each Scale has about five hundred Apertures, or Pores; so that a grain of Sand will cover 125000 Pores through which we perspire.

These Pores are Emunctory of the redundances of the Blood, and by means of Perspiration.

These Pores or the Extremities of the Arteries, which in cutaneous Disorders, pour out a sharp acid Lymphæ, which if it remains long under the Epidermis, cause a continual Itching and Corrod; the Cutis as we see, in those who had the small Pox.

Therefore the best Method that I have found in those, who were very full of Pimples in the small Pox, of the confluent Sort, is to let out the Matter as it gathers under the Epidermis:

piration,

piration, and by the Effects of topical Applications : And from these two Phænomena, they have been divided into artèrial and venal Pores.

We ought likewise to observe the Adhesions and Folds of the Skin. It is every where united to the Corpus Adiposum, as shall be said hereafter : But it adheres to it much more closely in some Parts, than in others, as in the Palm of the Hand, Sole of the Foot, Elbow, and Knee.

Some Plica, or Folds in the Skin, depend on the Structure of the Membrana Adiposa or Cellularis as those in the Neck and Nates ; others do not depend on that Membrane, such as the Rugæ in Fore-head Palpebra, which are formed by cutaneous Muscles, and disposed more or less in a contrary Direction to these Muscles. These Folds increase with Age.

There is besides a particular kind of Folds in the Skin of the Elbow, Knee, and Condyles of the Fingers and Toes, which are owing neither to the Conformation of the Membrana Adiposa, nor to any Muscle.

Lastly, there is a kind of Plica, or rather Lines, which cross the Lines of the Hand, Sole of the Foot, and corresponding Sides of the Fingers and Toes in different Directions. These serve for Employment to Fortune-tellers.

#### THE CUTICULA, OR EPIDERMIS.

The exterior Side of the Skin is covered by a thin transparent Web, closely joined to it, which is called Epidermis Cuticula, or the Scarf-skin.

The Substance of the Cuticula appears to be very uniform on the Side next the Skin, and to be composed, on the other Side, of a great Number of very fine squamous Laminæ, without any Ap-  
I
pearance

pearance of a fibrous or vascular Texture,\* except some small Filaments by which it is connected to the Papillæ, and which perhaps are detached from thence.

This Substance is very solid and compact, but yet capable of being extended and thickened, as we see by steeping it in Water, and by the Blisters raised on the Skin by Vesicatories, or any other Means; and from thence it should seem, that it is of a spongy Texture. It yields very much in Swellings, but not so much as the Skin, without breaking or cracking.

The Origin of the Epidermis is as obscure, as its Regeneration is evident, sudden, and surprising; for let it be distorted ever so often, it still grows again. It probably rises from a Substance that transudes from the Papillæ, and therefore the Ancients were in the right to call it an Efflorescence of the Skin.

We must not however imagine, that it is the Air dries this mucilaginous Matter, and gives it the Form of the Epidermis; because it is found equally in the Fœtus, which swims continually in Water; and it grows ever in the Palate, when it has been destroyed by too hot Food; and under Plasters applied to any Part of the Body.

Hard and reiterated Frictions loosen it insensibly, and presently afterward, a new Stratum arises, which thrusts the first outward, and may itself be loosened, and thrust outward, by a third Stratum, and so on.

It is nearly in the same Manner, that Callosities formed on the Feet, Hands, and Knees; and the several Laminæ or Strata observable at the same

\* RUYSCII, with all his fine Injections, he nor others never injected it.

time, on many other Parts of the Body are owing to the same Cause, though many Anatomists have looked upon them to be natural. It must be acknowledged, however, that on the Palms of the Hands, and Soles of the Feet, the Epidermis is commonly thicker than on any other Part.

The Epidermis adheres very closely to the cutaneous Papillæ, from which it may be separated by boiling; or which is a better way, by steeping for a long time in Water. It is not impossible to separate it with the Knife, but this Management teaches us nothing of its Structure.

It adheres still closer to the Corpus Reticulare, which is easily raised along with it; and they seem to be true Portions or Continuations of each other.

It is generally believed, that the Colour of the Epidermis is naturally white; and that the apparent Colour thereof is owing to that of the Corpus Mucosum. But when we examine separately the Epidermis of Negroes, we find no other Whiteness in it, than in a thin transparent Lamina of black Horn.

The Epidermis covers the Skin through its whole Extent, except at the Places where the Nails lie. It is marked with the same Furrows and Lozenges as the Skin, and has the same Openings and Pores; and though it may be said to pass the Bounds of the Skin, where it is continued inward, through the greatest Openings, yet at these Places it loses the Name of Epidermis.

When we examine narrowly the small Pores or Holes, through which the Sweat passes, the Epidermis seems to enter these, in order to complete the extraordinary Tubes of the cutaneous Glands. The Fossulæ of the Hairs have likewise the same Productions of the Epidermis, and it seems to give a sort of Coat or Bark to the Hairs themselves.

Lastly,

Lastly, the almost imperceptible Ducts of the cutaneous Pores are lined by it.

Having macerated the Skin for a long while in Water, the Epidermis, with all its Elongations, may be separated from it, and in that Case these Productions carry along with them the Hairs, the Bulbs, and even the axillary Glands.

By this Observation, we may explain how Blisters may remain for along time on the Skin, without giving Passage through these Pores, to the Matter which they contain, which Pores ought to be increased, one would think, by this Dilatation and Extension of the Epidermis.

For when the Epidermis is separated from the Skin, it carries along with it some Parts of the cutaneous Fibres, which being compressed by the Matter contained in the Blister, shut the Pores of separated Epidermis like so many Valves; and it is probably these small Portions have been taken for Valves of the cutaneous Tubes\*.

#### USES OF THE SKIN.

It is chiefly and properly the filamentary Substance, called the Body of the Skin, which is the

\* RUYSCH has separated the Cuticulæ from the Cutis of a Negroe, and found it to be White, as in Europeans; but the exterior Superficies of the separated Part of the Cuticula was blackish; and its interior Surface, where the Corpus Reticulare came in View, of a deep Black. It is evident, from this, that the Seat of the Blackness in the Skins of these People, is neither in the Cuticula nor Cutis, but in the Cutis Reticulare, vid. Adversor, Anat. LITRE has made the same Experiment, but it did not prove so.

SANTORINI, observes the same, He says that the Colour of the Skins of the Europeans, is owing to that of the Bile; that it is yellow in the Jaundice, black in its last Stages, and of a deadish white in the Chlorosis, because the Bile itself is of these several Colours in these Diseases, Vid. Observat. Anat.

See also, l'Histoire de l'Acad. des Sciences, 1702. & Memoires de Trevoux, 1738.

universal

## LECT. XIII. Of the Teguments. 271

universal Integument of the Body, and the Basis of all the other cutaneous Parts, each of which has its particular Uses.

The Skin is able to resist external Injuries to a certain Degree, and such Impressions, Frictions, Strokes, &c. to which the human Body is often liable, as would hurt, wound, and disorder the Parts of which it is composed, if they were not defended by the Skin.

The Papillæ are the Organs of Feeling, and contribute to an universal Evacuation, called insensible Transpiration. They likewise serve to transmit from without, inwards, the subtle Particles or Impressions of some Things applied to the Skin. The first of these three Uses depends on the Extremities of the Nerves, the second on the arterial Productions, and the third on the Productions on the Veins.

The cutaneous Glands secrete an oily Humour of different Consistencies, and they are likewise the Origin of Sweat. But without the Epidermis, both Papillæ and Glands would be disturbed in their Functions, on which great Disorders must ensue.

In order to explain the Mechanism of Feeling, or the Touch; we should first be made acquainted with the Senses in general, for which this is not a proper Place; and therefore all that I shall observe here, is, that there are at least two sorts of Feeling, one Particular, the other General.

Particular Feeling is accompanied with a certain determinate Impression, by which we are enabled to discern Objects in a very different Manner, and this is properly what is called the Touch; the proper Organ of which is at the Inside of the Ends of the Fingers. General Feeling is indeterminate and indistinct, not being accompanied with the Impression as the former.

These

These Differences, in the Sense of Feeling, depend on those of the Papilla; which, in effect, appear to be more close, and made up of a greater Number of Filaments at the Ends of the Fingers than any where else; for the nervous Filaments that go to the Fingers, are proportionally longer than those that go to any other Part of the Body.

The Epidermis serves to keep the Pencils, or nervous Filaments of the Papillæ, in an even Situation, and without Confusion; and it likewise moderates the Impressions of external Objects. Particular, as well as general, Feeling is more or less perfect, in proportion to the Thickness of the Epidermis, Callosities, in which, have been some times seen to destroy both.

Another Use of the Epidermis is to regulate the cutaneous Evacuations already mentioned; the most considerable of which is insensible Transpiration. By this we understand a fine Exhalation, or a kind of subtle Smoke, which flows out of the Body imperceptibly, and in different Quantities. It might be cutaneous Transpiration, to distinguish it from a pulmonary one.

This cutaneous Exhalation becomes sensible by applying the End of the Finger, or Palm of the Hand to the Surface of a Looking-glass, or of any other polished Body; for it presently looks dull, and appears to be covered with a condensed Vapour. It seems to me, that the convex Sides of the Hand and Fingers, furnish so great a Quantity of this Exhalation, as the Palm of the Hand and the Insides of the Fingers; especially the Extremities which point out the Use of this Transpiration, viz. to cup the nervous Filaments in due Order for particular Feeling\*.

We

---

\* The Proof of insensible Transpiration is the famous Experiment of SANCTORIUS, continued for thirty Years without Interruption, by which



We may render this Transpiration visible to the Distance of about half a Foot from the Body; if we look at the Shadow of the bare Head against a white Wall, in a bright Sun-shiny Day, and in the Summer Season, we shall perceive very distinctly, the Shadow of a flying Smoke, arising out of the Head, and ascending, though we cannot see the Smoke itself. We may try the same Experiment with Dog or Fowl.

It is much in the same Manner, that the invisible Exhalations from burning Charcoal throw a very different Shadow; and that the invisible Smoke of a Chafing-dish, Warming-pan, Stove, &c. make all distant Objects appear trembling, when viewed on either Side of those Utensils.

The invisible cutaneous Evacuation is performed simply, and without any Artifice, through the small Pores already mentioned, much in the same Manner as we observe the Smoke to arise from the Intrails of an Animal newly killed and opened. It is a particular and continual Discharge of the Serum of the Blood, through the capillary Vessels of the Skin.

It is naturally very moderate, and it is more abundant in the Summer, before a good Fire, after strong Exercise, and during the Distribution of the Chyle; than in the Winter, in cold Places, during Inaction, and before Meals.

The transpired Matter appears to be in some Degree saline, as may be observed, by applying the

which he found this Evacuation in one Day, was equal to all the sensible Evacuations for fifteen Days.

This Calculation is not agreeable to what has been made in other Countries, particularly those from the like Experiments made by DORDAL and MORIN, of the royal Academy of Sciences, and by Dr. JAMES KEIL. Neither can the Balance inform us, whether the cutaneous Transpiration is greater or less than the Pulmonary ones.

Tongue to the Palm of the Hand, when it has not been lately washed before. This is perhaps the Reason, why we feel less Pain when a Wound is touched with the Finger covered with Silk, than with the naked Finger; but this Inconveniency might easily be prevented by washing the Hands and Fingers very well, immediately before we begin to dress Wounds. The Matter of the other two cutaneous Evacuations, the Sweat and thick oily Substance comes chiefly from the Glands of the Skin. Each of them differ according to the different Parts of the Body where they are found, as may be observed of the Filth and Sweat of the Head, Arm-pits, Hands, Feet, &c.

This Filth or Nastiness of the Skin, is an unctuous or fatty Matter collected insensibly from the Epidermis, where it thickens and forms a sort of Varnish, which in Time becomes prejudicial, by stopping up the Passages of cutaneous Transpirations\*.

#### OBSERVATIONS.

On examining the Substance and Structure of the Cutis, we found it to be composed of a Multitude of tendinous Fibres, single, tenacious, and interwoven, in a surprising Manner together; and the vast Number of sanguineous Vessels and Nerves, which constitute the Papillæ, and raise themselves thro' the Pores of the Corpus Reticulare. These, when the Cuticula is taken off, are very obvious in the Palms of the Hands, and under the Soles of the Feet, also at the Ends of the Fingers; whereby

---

\* This happens oftener in the Winter, than the Summer; and this is the Reason why it is more difficult to keep the Hands clean in cold, than in warm Weather. And while we are dissecting in Winter, the oftener we wash our Hands, the less sensible they are of Cold.

we constitute the Sense Ta $\dot{c}$ t, or Touch, and Feeling.

What we have hitherto observed is sufficient to enable us to understand the Nature of Ta $\dot{c}$ t. The Papillæ, seated in the longer winding Ridges, at the Extremities of the Fingers, regularly disposed in spinal Placæ, are, by the Attention of the Mind, a little raised or erected, as appears in respect of Frights or Shiverings, as we see in the Nipples of Women, in the handling of tangible Objects, and by Friction; whereby, receiving the Impression of the Object into their nervous Fabric, it is thence conveyed, by the Branches of the Nerves, to the Brain. This is what we name the Ta $\dot{c}$ t, or Sense of Feeling; we become sensible of Heat when it exceeds in the Bodies of our Fingers; and Weight likewise, when it presses more than usual.

Humidity, we judge of by the Presence of Water, and Softness or yielding of the Subject: Hardness from the Resistance to the Finger: Figure, from the Limits or rough circumscribed Surface: Distance from a rude Calculation or Estimate made by Experience, to which the Length of the Arm serves as a Measure: So the Touch serves to correct the Mistakes of our other Senses.

The mucous Substance observed, first by MALPIGHIIUS; moderates the Action of the tactile Subject, and preserves the Softness and sound State of the Papillæ. The Cuticula excludes the Air from withering and destroying the Skin, qualifies the Impressions of the externous Bodies, so that they may be only sufficient to affect the Touch, without causing Pain; and therefore, when it is become too thick by Use, the Sense of Feeling is either lost or lessened; but if it be thin and soft, the Feet become painful.

The most important Office is an emunctory Instrument, to perspire or exhale from the Body,

larger Quantity of Humours and other Matters, to be carried off by the Air. Accordingly, the whole Surface of the Skin vapours, by an infinite Number of small Arteries, either coiled up into Papillæ, or spread on the Skin itself, which pass out, and exhale throughout corresponding Pores of the Cuticula; although the Course or Direction of the Vessels which pour out this Vapour be changed in passing from the Skin to the Cuticula. These exhaling Vessels or Arteries are easily demonstrated, by Injection; or in living Persons, this Exhalation is easily demonstrated by a clear Looking-Glass being placed against the warm and naked Skin, whenever the Motion of the Blood is increased white, at the same time the Skin is hot and relaxed, the small cutaneous Pores, in lieu of an invisible Vapour, discharge Sweat, consisting of minute, but visible Drops, which run together into larger Drops, by joining with others of the same kind. But those Parts chiefly are subject to Sweat which are hottest; that is to say, where the subcutaneous Arteries are largest, and have a greater Action from their resistance, as in the Head, Breast, and Foldings of the Skin. The Experiment already mentioned, together with the Simplicity of Nature herself, joining with the visible Thickness or Cloudiness of the cutaneous and pulmonary Exhalation, sufficiently persuades us, that the perspirable Matter and Sweat are discharged through the same kind of Vessels; and differ only in the Quantity and Celerity of the Matter, which, together with the Sweat, intermixed with the sebaceous Humour of the Glands and the subcutaneous Oil, which being more plentifully secreted, and diluted with the arterial Juice, flows out of an oily and yellow Consistence; chiefly gives that Smell and Colour to the Sweat, for which it is so remarkable. Hence we find it more foetid in  
the

## Lect. XIII. Of the Teguments. 277

the Arm-pits, Groins, and other Parts, where those Glandules are most numerous.

Concerning the Nature of Perspiration, we are to enquire by Experiments, and by Analogy, with the pulmonary Exhalation, which more frequently and abundantly perspires a vaporous Cloud of the same Kind, more especially visible in a cold Air. That which flies off from the Body, in this Exhalation, is chiefly Water, appears from Experiments, by which the Breath being condensed in large Vessels, forms or gathers into watery Drops. Agreeable to this, we find the obscuring Vapours subtle, so as wholly to fly off again from it; and the same is confirmed by the obstructed Matter of Perspiration passing off by Urine, or more frequently changing into a Diarrhœa; and from the easy Passage of warm Liquors in the Form of Perspiration, by hot Air; or else by the urinary Passages in cold ones.

The Sweat is evidently of a saline Nature, as appears both from the Taste, and from the minute Crystals that appear to shoot upon the Cloaths of such as work in Glass-Houses; as well as by Distillation, which shews the Sweat to be of an alkaline Nature. Hence it is, that by this Discharge, the most malignant Matter of many Diseases is thrown off from the Body. But in reality, Sweats are always a preternatural or morbid Discharge, from which a Person ought always to be free, unless by violent Exercise, or other Accidents, his Constitution is for a shorter time in a diseased State. Nor is it unfrequent for Sweats to do considerable Mischief in acute Diseases, by wasting the aqueous Particles, and thickening the rest of the Blood, at the same time it renders the Salts more acrimonious. By a too violent Motion of the Blood, the Sweat is rendered extremely foetid; and being electrified, it is sometimes lucid.

The Uses of Perspiration are to free the Blood from its redundant Water, and throw out those Particles, which, by repeated Circulation, have become alkaline, or otherwise acrimonious, and possibly to exhale therewith an extreme volatile Pill, prepared from the same Blood. The same Perspiration likewise qualifies and softens the Cuticule, which is a necessary Medium, extended before the tender sensible Papillæ.

But the same Skin that makes this Exhalation into the Air, is likewise full of small Vessels, which inhale or absorb thin Vapours from the Air, either perpetually, at least when it is very solid; more especially when the Air is damp, the Body unexercised, the Mind oppressed with Grief, or both under Considerations contrary to those Veins are demonstrated by anatomical Injections; which, if thin or watery Sweat passes through them in the same Manner as through the Arteries, moreover the manifest Operations of Medicines in the Blood, which were exhaled into the Air, or applied to the Skin, prove the same, such as the Vapours of Mercury, Turpentine, Saffron, Bath-waters, Mercurial-plasters, Tobacco, Calloquintida, Opium, Cantharides, Arsenic, with the fatal Effects of contagious or other Poisons, entering through the Air, as in the Venereal Infection; to which add the living of Animals, almost without Drink in hot Islands, which abound with moist Vapours, from which, however, they sweat and piss plentifully enough. Lastly, some extraordinary morbid Cases have demonstrated thin, in which a much greater Quantity of Urine has been discharged, than the Quantity of Drink taken in. The Proportion of this Inhalation is difficult to assign; but that it is very great in Plants, more especially in the Night-time, appears evidently from certain Experiments; which may be seen in the vegetable Statics of Dr. HALES.

These

These cutaneous Vessels, both exhaling and inhaling, are capable of Contraction and Relaxation by the Power of the Nerves. The Truth of this appears from the Effects of Passions of the Mind, which, if joyful, increase the Circulation, and relax the exhaling Vessels, so as to yield easier to the Impulse of the Blood; from whence, with a shortening of the Nerves, there follows a Redness, Moisture, and Turgescence of the Skin. Those Passions, on the contrary, which are sorrowful, and retard the Circulation, contract the exhaling Vessels, as appears from the Driness and Corrugation of the Skin, like a Goose's Skin after Frights, and from a Diarrhœa covered by Scars. But the same Affections seem to open and increase the Power of the exhaling Vessels, whence the variolous or pestilential Contagions are easily contracted by Fear.

#### OF THE MEMBRANA ADIPOSA AND FAT.

The second universal Integument of the human Body is the Membrana Adiposa, or Corpus Adiposum. This is not, however, a single Membrane, but a Congeries of a great Number of membranous Laminæ, joined irregularly to each other at different Distances, so as to form numerous Interstices; which have been named Cellulæ, and the Substance composed of them, the cellulous Substance.

The Thickness of the Membrana Adiposa is not the same all over the Body, and depends on the Laminæ of which it is made up. It adheres very closely to the Skin, runs in between the Muscles in general, and between their several Fibres in particular, and communicates with the Membrane, which lines the Inside of the Thorax and Abdomen.

This Structure is demonstrated every Day, in blowing up Meat, when newly killed; in

doing which, they not only swell the Membrana Adiposa, but the Air insinuates itself likewise into the Interstices of the Muscles, and penetrates even to the Viscera, producing a kind of artificial Emphysema.

These cellular Interstices are so many little Bags or Satchels, filled with an unctuous or oily Juice, more or less languid, which is called Fat, the different Consistence of which depends not only on that of the oily Substance, but on the Size, Extent, and Subdivision of the Cells\*.

That is more fluid in living, than in dead Bodies, it melts with the Heat of the Fingers in handling it, and its Fluidity is in part obstructed by the Sacculi, which contain it. To take it intirely out of these Bags, the Method is to set the whole over the Fire, in a proper Vessel; for then the Bags burst, and swim in Clusters in the true oily Fluid.

This Substance increases in Quantiry in the Body, by Rest and Good-living; and, in the contrary diminishes by hard Labour, and a spare Diet. Why Nourishment should have this Effect is easily conceived, and it is likewise easy to see, that an idle sedentary Life must render the Fat less fluid, and consequently more capable of blocking up the Passages of insensible Transpiration, through which it would otherwise run off.

\* MALPIGHI took a great deal of Pains about that Substance; that in Birds and Frogs, the Viscera and Vessels of which are transparent, he thought he saw a kind of Ductus Adiposi; and that, by pressing these Ducts, he observed oily Drops to run distinctly into the small Ramifications of the Vena Portæ.

The Manufacture of Soap, the Composition of the Unguentum Nutritum, and the different Mixtures of Oil, with saline and acid Liquors, give us some Idea at least, of the Formation of the Fat, in the human Body; but the Organ which separates it from the Mass of Blood, which ought to be the Subject of our present Inquiry, is not as yet sufficiently known.

Hard



Hard Labour dissolves it, and consequently fits it for passing out of the Body, with the other of insensible Transpiration. Some are of Opinion that it returns into the Mass of Blood, by the capillary Veins and that it can, for some certain time, supply the Want of Nourishment.

By this they think, the long Abstinence of some Animals may be explained; but I am apt to believe, that the mere Decrease of cutaneous Transpiration, occasioned by the continual Rest, and Inaction of these Animals, has a great Share in this Effect.

The proportional Differences in the Thickness of these Membrana Adiposa are determined, and may be observed to be regular in some Parts of the Body, where either Beauty or Use required it.

Thus we find it in great Quantities, where the Interstices of the Muscles would otherwise have left disagreeable hollow or void Places; but being filled, and as it were padded with Fat, the Skin is raised, and an agreeable Form given to the Part.

The Appearance of a Person moderately fat, of a Person extremely lean, and of dead Subjects, from which all the Fat has been removed, proves sufficiently what we observe.

In some Places the Fat seems to be braced down by a kind of natural Contraction in Form of a Fold; as in that Fold which separates the Basis of the Chin from the Neck, and in that which distinguishes the Buttocks from the Rest of the Thigh. We observe it likewise to be entirely sunk, or as it were performed by a kind of Dimple or Fossula, as in the Navel of fat Persons.

These Depressions and Folds are never obliterated, let the Person be ever so fat, because they are not natural, and depend on the particular Conformations

formation of the Membrana Adiposa, the Laminæ of which are wanting at these Places.

The Fat is likewise of great Use to the Muscles in preserving the Flexibility necessary for their Actions, and in preventing or lessening their mutual Frictions. This Use is of the same Kind with that of the mucilaginous Matter found in the Articulations, as we have already observed.

Lastly, the Fat, as a fine oleaginous Substance in its natural State, may be some Defence against the Cold, which we find makes more Impression on lean than on fat Persons. It is for this Reason, that to guard themselves against the excessive Colds of hard Winters, and to prevent Chilblains; Travellers rub the Extremities of their Bodies, and especially their Feet with spirituous Oils, such as that of Turpentine, &c.

This Mass of Fat, which makes an universal Integument of the Body, is different from that which is found in the Abdomen, Thorax, Canal of the Spina Dorſi, Articulations of the Bones, and in the Bones themselves.

But the Difference of all these particular Masses of Fat consists chiefly, as I have said in the Thickness or Firmness of the Pellicles, in the Largeness or Smallness of the Cells and in the Consistence, Fluidity, and Subtilty of the oleaginous Matter.

#### OBSERVATIONS.

The cellular Substance is without Fat only in a few Places, to allow a necessary Motion to the Skin, where it is replenished with it; and serves to defend the internal Parts from the cold Air, to render the Skin moveable upon the Muscles, to fill up the Cavities betwixt the Muscles themselves, and to render the whole Body white and uniform. The Cutis, Cuticula, and Malpighius

h<sup>us</sup> Mucus, serve not only to limit the external Bounds of the Body every where, but likewise where they seem to be perforated; passing internally, they degenerate gradually. For the Cuticula is manifestly extended into the Anus, Urethra, Vagina, Cornua of the Eye, auditory Passage, Mouth and Tongue; nor is it absent in the Stomach and Intestines, although, by the perpetual Warmth and Moisture, its Fabric be altered and extended, or relaxed into their villous Teguments. Thus the true Skin is continued into the internal Fabric of the Palate, Tongue, Pharynx, Nostrils, Vagina, &c. where it degenerates always into a white, thick Pulp, commonly called nervous Tunic of those Parts.

When the Membrana Adiposa are inflamed, and degenerate into Suppuration, in some fat Subjects, they make it very tedious in healing, as the Vesiculi soon infect one another; therefore the best Method to procure a speedy Cure is not to spare Amputation freely, if it is in a convenient Part of the Body. In some Subjects, these Cellulæ Adiposæ are an Accumulation of Fat, which forms a large Tumor, which I think is occasioned by the absorbent Vessels, which correspond to the adjacent Part where the Tumor is formed, wherefore the Arteries continually distil the oleaginous Part of the Blood into the Cellulæ.

PETIT has amputated one of these Tumors from a Woman, between the Shoulders, which weighed forty eight Pounds, and we read the like in various Authors.

The sanguinous Vessels of the Membrana Adiposa are very numerous, and arise from the circumjacent Parts; entering, as it were, and surrounding the Cells of the membranous Cellulæ. The Nerves are few, and very small, whence it has little Sensation. Authors mention, besides these, certain Vessels,

sels, which they name *Vasa Adiposa*; but it does not appear certainly, that there are any distinct Vessels from those we hereafter mention. That the oleaginous Matter of the Fat has a circulatory Motion, or an Egress into Veins, is very evident from the Consumption of it in many Diseases, which are extremely sudden; and from its vast and almost immoderate Diminution, only from the Effect of any violent Exercise, or in acute Diseases.

MORGAGNI is of opinion, that the Epidermis is nothing else but the Superficies of the Cutis, which grows hard, and as it were, in some degree, callous, by the external Compression; thence indurates to be insensible, and, as it were, dead. But we observe that the Epidermis is perfectly formed in the Fœtus State; while in Utero, when there have not been these Causes of Induration; where the whole Surface of the Body has been surrounded by the Liquor Amnii, which is soft and mucilaginous, and by no means capable of making such a Compression of Induration.

RUYSCH tells us, in his *Aversaria*, how to prepare, in a beautiful Manner, the Cuticula and Corpus Reticulare of MALPIGHI.

SWAMMERDAM and ST. ANDRE do not only say the Epidermis has Vessels, but to have injected them; but I am rather apt to think that they took the Injections which run under it in the Cutis, which will make it appear as if the Epidermis was really injected, but we find the contrary, when we take it off from the Skin.

Besides this reticular Substance, there is another, which may be called properly enough the Rete Cutaneum, or Rete of the Cutis. This is formed by the Vessels, which are dispersed all over the Skin: These Vessels receive in general, no other Fluid but Lymph; and to that it is owing; that the whole Surface of the Body with us is white. It has been  
supposed

supposed, that in Negroes this reticular Substance was formed of larger Tubes; and from hence, Authors have argued, that in consequence of their larger Sizes, these Vessels may have received Blood into them in those Subjects, and that this Blood divested of its Lymph and other aqueous Matter by Transpiration, became black in them, and was the Occasion of their black Colour. This has a Shew of Reason; but we are at present very well assured, that the black Colour of these People is solely and entirely owing to a black Matter, of a peculiar Kind, lodged in the Corpus Reticulare, though we are not acquainted with its Origin.

There are People always of a florid red Colour, from the Blood in the Vessels of the Skin, not being divested of its Lymph; and in general, according to the Nature of the Blood and other Liquors which enter these Vessels, the Skin is differently coloured. We are not to suppose it wonderful, that the Vessels of the Skin are not exactly of the same Size in all People; for we find that they vary extremely in this Particular, in the different Parts of the Body in the same Person. In the Cheeks, they are naturally very large, whence there is in general a florid Colour there; and the Blood being capable of rushing into them on any Occasion, it is in them, that Flushings of red are first seen from Exercise, or a thousand other Occasions. In many of our Passions, the nervous Fluid being forced violently along its Passages, they press upon the Arteries, and force the Blood into the lateral Tubercles, which form this reticular Substance; hence it is, that we grow red with these Passions. If the Passion be more violent still, and the nervous Fluid urged on with greater Force, the Arteries may be so pressed upon, as to prevent the Blood's passing at all along its own little Canals; and to  
this

this it is owing, that we turn pale with Anger, and with many other very violent Passions.

The same Consequence will happen also, tho' on another Principle, if, on the contrary, the nervous Fluid is not propelled at all, for want of Force in the Nerves : In this Case the Heart will not send the Blood at all into these minute Vessels, and consequently we become pale, as in the other Case. This is the Origin of the Paleness, which seizes us in Terror, &c.

### THE NAILS.

The Nails are looked upon by some as Productions of the cutaneous Papillæ; and by others as a Continuation of the Epidermis. This last Opinion agrees with Experiments made by Maceration, by Means of which the Epidermis may be separated entire from the Hands and Feet, like a Glove with the Nails.

In this Experiment, we see the Nails part from the Papillæ, and go along with the Epidermis, to which they remain united like a kind of Appendix, and yet their Substance and Structure appear to be very different from that of the Epidermis.

Their Substance is like that of Horn, and they are composed of several Planes of longitudinal Fibres folded together. These Strata end at the Extremity of each Finger, and are all nearly of an equal Thickness, but of different Breadths, and Lengths.

The external Plane or Stratum is the longest, and the rest decrease gradually, the inner, mostly being the shortest; so that the Nail increases in the Thickness from its Union with the Epidermis, where it is thinnest, to the End of the Finger where it is thickest.

The

The graduated Extremities or Roots of all the Fibres of which these Planes subsist, are hollowed for the Reception of the same Number of very small oblique Papillæ, which are Continuations of the true Skin; having reached to the Root of the Nail, form a semi-lunar Fold, in which the Root is lodged.

After the semi-lunar Fold, the Skin is continued on the whole inner Surface of the Nail, the Papillæ insinuating themselves in the Manner already said. The Fold of the Skin is accompanied by the Epidermis, to the Rete of the Nails exteriorly, to which it adheres very closely.

Three Parts are generally distinguished in the Nail, the Root, Body, and Extremity. The Root is white, and in Form of a Crescent; and the greatest Part of it is hid under the semi-lunar Fold already mentioned.

The Crescent and the Fold lie in contrary Directions to each other. The Body of the Nail is naturally curvated, transparent, and appears of the Colour of the cutaneous Papillæ which lie under it. The Extremity of the Nail does not adhere to any thing, and still continues to grow as often as it is cut.

The principal Use of the Nail, is to strengthen the Ends of the Fingers and Toes, and to hinder them from being inverted towards the convex Side of the Hand or Foot, when we handle or press upon any thing hard. For in the Hand, the strongest and most frequent Impressions are made on the Side of the Palm, and in the Foot on the Sole; and therefore the Nails serve rather for Buttresses, than for Shields.

#### OBSERVATIONS.

The Nail itself is of a soft tender Fabric where it first arises, partly covered by the Skin; but by Age and Contact with the Air, it, in time, hardens

into a solid, horny, and elastic Body, composed of long Hair like Filaments, cemented together by interposed Glue, and distinguishable from each other, by intervening Sulci, by which one may be able to split them into a Number of lesser Orders.

The Nail, thus formed, extends itself to the Extremity of the Finger, and is in this Tract lined all along internally within its concave Surface, by an Expansion of the Cutis, and subjacent Periosteum intermixed, the Filaments of which arise first short, and are afterwards continued to a great Length, till they become longest of all at the Extremity of the Nail. Over, or upon, the external Surface of the Nail, some Part of the Skin is again folded, but free and distinct about it. The Tendons, however, do not reach quite so far as the Nail.

The Substance of the Nails. They are composed of the cutaneous Papillæ, elongated and indurated, firmly connected to one another in a longitudinal Direction; for this Reason, they are very sensible at the Roots, when these Papillæ are yet tender: But at the Apex, where they are perfectly indurated, they may be cut without Pain.

Among the various Animals, the Claws, which are analogous to our Nails, serve them for seizing and tearing their Prey, and for climbing the Trees, as, Squirrels, &c. make the latter Use of them; the Beasts of Prey in general, the former. Among the other Animals, in some they serve as Shoes to to walk on: In others, they answer both this Purpose and that of offensive Weapons, as in Horses, to strike with, &c. Vid. SCHRADER, Dissert. de Armatura Brutorum.

#### THE HAIRS.

The Hairs belong as much to the Teguments as the Nails. They are a kind of Reeds or Rushes,  
the



## Lect. XIII. Of the Teguments. 289

the Roots or Bulbs of which lie toward that Side of the Skin, which is next the Membrana Adiposa. The Trunk or Beginning of the Steam perforates the Skin, to a certain Distance, which is very various in the different Parts of the Body.

When the different Hairs are examined by a Microscope, we find the Roots more or less oval, the largest Extremity being either turned toward, or fixed in, the Corpus Adiposum. The smallest Extremity is turned toward the Skin, and in some Places fixed in it.

This oval Root is covered by a whitish strong Membrane, in some measure elastic, and it is connected either to the Skin, to the Corpus Adiposum, or to both; by a great Number of very fine Vessels and Filaments.

Within the Roots, we observe a kind of Glue, some very fine Filaments which advance toward the small Extremity, where they unite and form the Steam, which passes through this small Extremity to the Skin. As the Uapour passes through the Root, the external Membrane is elongated in Form of a Tube, which closely invests the Steam, and is entirely united to it.

The Steam having reached the Surface of the Skin, pierces the Bottom of a small Fossula between the Papillæ, or sometimes a particular Papilla, and there it meets the Epidermis, which seems to be invested round it, and to unite with it entirely. A Sort of unctuous Matter transudes through the Sides of the Fossula, which is bestowed on the Stem, and accompanies it more or less, as it runs out from the Skin, in Form of a Hair.

Hairs differ in Length, Thickness, and Solidity, in the different Parts of the Body. Those on the Head, are called in English by the general Name of Hairs; those which are disposed Archways above the Eyes, Supercillia, or the Eye-brows;

those on the Margins of the Palpebra, Cilia, or the Eye-lashes; and those which surround the Mouth, and cover the Chin, the Beard. In other Parts of the Body, they have no particular Names; and their different Lengths, Thicknesses, in all these Parts, are sufficiently known.

Their natural Figure seems to be rather cylindrical than angular, which is chiefly accidental. Their Colour is probably the same with that of the Glue, or medullary Matter of the Root; the different Consistence of which makes the Hairs more or less hard, flexible, &c. Lastly, their strait or crooked Direction must depend on that of the Pores, through which the Stems pass.

The Use of the Hairs, with respect to the Human Body, in general, is not sufficiently known to be determined with Certainty. Their Uses, with regard to some particular Parts, may be discovered, as we shall see in the Description of these Parts; and are found to be unequal, irregular, and often knotty; they are pellucid, but not hollow; the Extremities of them are often split into several Portions.

The Portion of the Hair, which is within the Cutis, is concave and vasculous, in the Manner of the Basis of the young Feathers in Birds: This vasculous Portion is inclosed in a Follicula, and is most obvious in a Cat's Whisker, or the Beards of other Animals.

The Origin of the Hairs is in the Cutis and Fat; probably from the Nerves also, as there is a very acute Pain felt in pulling them off. See Chirac. Suppl. II. Act. Eruditorum, Tom. VIII.

The nutritious Matter of the Hair is probably the same with that of the other Parts of the Body, not merely excrementitious, as the Ancients thought; as there are, upon the internal Surfaces of all the Cavities of the Body, exhaling Arteries which

which perpetually throw out a fine Fluid to moisten and cuticate the Parts ; so there are bibulous Veins which take it up ; whose Existence is proved, not only by no Liquors being in Health collected in these Cavities, but also by anatomical Injections.

Besides the Teguments, which I have here described, the Ancients reckoned two others, the *Panniculus Carnosus* and *Membrana Communis Musculorum*.

The *Panniculus Carnosus* is found in Quadrupeds, but not in Men, whose cutaneous Muscles are very few in Number, and most of them of a very small Extent, except that which I call *Musculus Cutaneus* in particular ; but even that Muscle cannot in any tolerable Sense be reckoned a common Tegument.

There is no common Membrane of the Muscles, which covers the Body like a Tegument ; it being no more than particular Expansions of their aponeurotic Membrane.

The Elongations of the Lamina of the *Membrana Adiposa*, or *Cellularis*, may likewise have given rise to this Mistake, especially in such Places, where this Membrane is closely united to the proper Membrane of the Muscles.

#### OBSERVATIONS.

FROM DR. WHYTT'S PHYSIOLOGICAL ESSAYS.

The absorbent Veins of the Body which, like those of the Intestines, have no Valves, take up by their Attraction as capillary Tubes, the rarified Vapour of the Arteries ; after which, it is conveyed on, to the sanguiferous Veins in which they terminate, by their vibrating Motion, the Pulsation of adjacent Arteries, and the Compression of Muscles. The

Absorption in the Cavities of the Abdomen and Thorax is greatly promoted by the alternate Pressure of the Muscles concerned in Respiration; while the Muscles of voluntary Motion, employed in all kinds of Exercise and Labour, by accelerating the Motion of the Fluids, in the absorbent Vessels of the Trunk, and Extremities of the Body, enable them to imbibe more copiously. And hence we may see, why Animals which move little are oppressed with Fat, while those kept at hard Labour, are very lean. In the former, the absorbent Vessels of the fatty Cells, imbibe the oily Matter deposited there very slowly, because they want the alternate Pressure of the Muscles of voluntary Motion, to push their contained Fluid anteriorly to the larger Veins; in the latter, the Absorption from those Cells is not only increased by the various and continually repeated Pressures of the acting Muscles, but the Body being, by much Exercise, in some measure, exhausted of Fluids, the Veins imbibe more greedily, while the discerning Arteries pour forth their oily Liquors more sparingly.

If the exhalant Vessels of any Cavity throw out too much, or if the absorbent Power of the Veins be weakened, or if both these happen together, a water Fluid will be collected in it; and in this way, are produced Anascites, Hydrocele, Hydrops, Pectoris, &c.

When the Blood is thin and watery, and the Vessels weak, an œsarcous Oedemetous, and other dropfical Swellings are common; for, as the bibulous Veins can, by their Attraction, only take up Fluids in Proportion to the Depletion, they suffer by Means of their own vibratory Contractions, and the alternate Compression of neighbouring Arteries and Muscles; their absorbing Power must necessarily

cessarily be lessened in a lax State of the Fibres, where those Causes are much weakened.

Further, while the Redundance of watery Fluid in the Blood increases the Exhalation by the small Arteries, it lessens the Imbibition by the Veins, for the same Reasons that Ashes, Sugar, or Salts, when moistened, attract the aqueous Particles of the Air, less strongly than when they are dry.

Again, altho' there be little or no Fault in the Blood itself, yet, if its Return from any Part to the Heart, be much retarded, a Dropsy of that Part will soon follow, because the Fluids, taken up by the Absorbents, will slowly, and not without Difficulty, be received into the large sanguiferous Veins; and as we have just now observed, their Absorption must be in Proportion to their Depletion. Hence we see, scirrhus Tumours, Ligatures, and whatever compresses the Veins, soon bring on dropical Swellings.

It also appears, from what has been said, in what manner Diuretics and Purgatives carry off the stagnating Waters, in any Ascites and other Dropsies: Since, as, by the Discharges, they make by the Kidneys and Intestines, they not only lessen the Quantity of watery Fluid in the Blood, but also, by their Stimulus, increase the Force of their Circulation; the Exhalation by the Arteries must be lessened, at the same Time that the Imbibition by the Veins is increased.

The Surface of the Skin and Vessels of the the Lungs are, like the other Surfaces in the Body, endowed with exhaling Arteries and absorbent Veins; by the former, there is perpetually discharged from the Blood, a fine lymphatic Fluid; and, by the latter, the watery Particles floating in the Air are constantly conveyed into it.

When the Air is moist, and the Body has been exhausted by Fatigue, the Imbibition of those

Veins often exceeds the Exhalation by the Arteries; as the Drs. KEILL and LINNING have observed; (Medicin Stat. Britain. tab. iv, & observat. & Philosoph. tranfact. 20. 470.) but, taking the whole Year round, the Perspiration made by the Skin and Lungs, exceeds their Imbibition, by about forty Ounces a Day in Great Britain, and fifty four Ounces in South Carolina; which, tho' it has been commonly reckoned the Total of the Perspiration, is really no more than its Excess above the Quantity of Fluid, taken in by the absorbent Veins of the Skin, Fauces, and Lungs.

The remarkable Imbibition of the Skin observed by Dr. LINNING, July 3. 1740, betwixt  $2\frac{3}{4}$ , and  $5\frac{1}{8}$  afternoon, happened, tis true, without any preceding Fatigues; but is easily accounted for, from his having in that Time, discharged  $28\frac{6}{8}$  Ounces of Urine: Since so great a Waste of the thinner Parts of the Blood must not only have diminished the Exhalation by the cutaneous perspiring Arteries, but also have increased the absorbent Power, of the imbibing Veins every where thro' the Body: and hence it is, that in a Diabates, the Urine often not only exceeds the Quantity of Liquors drank, but these are taken up so greedily by the absorbent Vessels of the Stomach and Intestines as to be discharged by the Kidneys, before one would have thought they had got into the Blood.

Although in Vegetables, the Vessels, which perspire in the Heat of the Day, frequently assume a contrary Office in the Night Season, and imbibe the Dew and watery Particles, then floating in the Air; yet it does not seem probable, that the exhaling or perspiring Vessels of Animals can thus become imbibing ones, or that the Moisture of the Air can be, by them conveyed into the Blood: Since any Motion in these Vessels, from their Extre-

mities

mities to their larger Trunks, must be in Opposition to the Course of the arterial Fluids.

The Imbibition by the Vessels of the Skin is performed in the same Manner, as in the other Absorbents ; only it is probable, that the perpetual varying Oscillations of the external Air may concur in promoting it. Although the Exhalations from animal, vegetable, and mineral Bodies, may be transmitted, along with the aqueous Particles in the Air, into the Blood ; by the absorbent Veins of the Skin and Lungs, and thus account for pestilential and epidemical Diseases raging at particular Seasons ; yet it is by no means probable, that the elastic Air can be imbibed by these Vessels, and thus conveyed into the Blood, for it has been observed that this Fluid moves with greater Difficulty thro' capillary Glass Tubes, tho' some hundred times larger than the Pores of the Skin\* ; and it is well known, that Water and other Fluids can penetrate many Substances there, which Air cannot pass.

This Observation of the Difficulty, with which, Air moves thro' capillary Tubes, may serve to determine a Controversy which has long subsisted among Physiologists, viz. Whether or not any elastic Air enters into the Blood by the Lungs. For, since a few Drops of Water, with small Portions of Air between them, in a capillary Tube, requires a greater Force, to make them ascend, that with which the Tube attracts the Particles of that Fluid ; (MUSCHENBROECK Loc. citat.) It must follow, that if any elastic Air were admitted into the absorbent Veins of the Lungs, it would

---

\* Arem verò non nisi tardè & cum quâdam Tenacitate per hos Tubos moveri, semper docuit Experimentia ; Arëi enim inest Species quædam Tenacitatis aut Immobilitatis, MUSCHENBROECK de tub. capill. vitri. Cap. 1. Exp. xi.

## 296 Of the Teguments. Lect. XIII.

not only move through them itself, but hinder their taking up, by their Attraction, any other Fluids.

The prodigious Swelling of Animals, in an exhausted Receiver, further shews, that Air cannot readily pass through the small Pores of the Skin and Lungs. Nor is it any Objection to this Doctrine, that Air has been found in the Cavities of the Heart; since, in a morbid State, this might arise from the Blood of which Air is a constituent Part, as well as of other Fluids. HALE'S statical Essays, Vol. 1. Chap. vi.

It is very observable, that Air injected into the Veins of an Animal produces Obstructions, Concretions, and sudden Death; which Effects, however, may be easily accounted for, from the Power which Air has of coagulating Blood, and from the surprising Influence it has in stopping the Motion of Water, even in large Pipes, especially when lodging in their Fluxes. Philosoph. Transact. N<sup>o</sup>. 393.

But, to return; as the Effluvia of different Substances floating in the Air, are, by means of the cutaneous Absorbents, conveyed into the Blood, so likewise are the finer Parts of Plasters, Cataplasms, Fomentation, and all other external Applications; which ought therefore to be considered, not only as having a topical Influence, but also as acting upon the whole Body by their subtiler Parts, which are mixed with the Blood and other Fluids.

It may be thought a Difficulty, that Quick-silver applied in the Form of an Ointment, should be taken in so readily by the absorbent Vessels of the Skin, since, as has been observed above, it passes through the Intestines without getting into the Lacteals. But this happens from the Particles of the Mercury being externally divided and so united with those of the Grease as to enter the Pores of  
the



the Skin along with them: for, tho' Quick-silver is repelled by capillary Glafs Tubes, yet, if their internal Surface is run over with melted Grease, it will be attracted by them\*.

We are told, that, upon opening the Bodies of such as had taken Mercury in large Quantities, this Fluid has been sometimes found in the Cellules of the Bones and elsewhere†; the Reason of which may be easily understood from what has been said above: For, if the very subtile and greatly divided Particles of Mercury should, after they are thrown out, by the exhaling Arteries, into any Cavity of the Body along with the finer Parts of the Blood, unite their strong mutual Attraction; so as to form Globules whose Diameters are larger than the Diameters of the absorbent Veins, it is evident they could never be taken up by these Vessels, but must remain for ever in such Cavity.

To conclude our Observations on the absorbent Vessels of Animals; it may not be improper to take Notice, that there are, upon the internal Surfaces of the Follicles, secretory and excretory Ducts of the Glands, bibulous Veins, whose Office is to carry off Fluids, which would be improper to enter into the several Secretions. And, if we suppose these absorbent Vessels, like other capillary Tubes, to attract, according to their different Natures, different Fluids, more or less strongly, we shall see one great Cause of the various Secretions performed in the Bodies of Animals.

---

\* Memoires de l'Academ. des Sciences, An. 1724, & MUSECHENBROECK de Tub. capill. Cap. iv. Exp. 12. Cor. 2. & Cap. vii.

† WEPFER de Appoex. p. 277. and MEAD on Poisons. Edit. 1. iii.



# LECTURE XIV.

## Of the MYOLOGY.



ALL the Motions of the Human Body, whether General or Particular, Natural or Preternatural, are immediately performed by Organs, which Anatomists name Muscles; and these are found in all the moveable Parts of the Body.

The Muscles in general are a Fasciculi of Fibres, of different Figures and Sizes, and, for the most part, consisting of two different Portions; one whereof is thick, soft, more or less red, and sometimes pale, forming what is called the Body, fleshy Substance, or Belly of the Muscle. The other is thin and small, of a close Contexture, and very White, forming the Extremities and other Parts, termed Tendons or Aponeuroses. The fleshy Portion is the principal and essential Part of the Muscle, being never wanting; but the tendinous or aponeurotic Portion is, in some Muscles, so very small, as to be invisible. Both Portions are covered by a particular Membrane.

The Fibres, of which a Muscle is composed, go by the general Name of Moving Fibres, and each of them, as well as the whole Muscle, is partly tendinous, and partly fleshy.

They are, for the most part, collected in Fasciculi, laterally, with respect to each other; and

and distinguished by membranous, cellular or adiposa Septa, as by so many particular Vaginæ.

These Fibres are connected to each other, and to the intermediate Septa, by a great Number of very small fine Filaments, the capillary Extremities of Arteries, Veins, and Nerves, running over them, and they are inclosed in a thin membranous cellular Covering, called the proper Membrane of the Muscle, being a Continuation of the Septa or Vaginæ, already mentioned.

All these Septa or Vaginæ communicate with each other, by a mutual and reciprocal Continuation of their cellulous Texture, and they are fixed transversly by filamentous or fibrous Pellicles, which cross them at small Distances from one another, and lie nearly in the same Direction, through the whole Body of the Muscle. The same sort of Fræna, are observable between the moving Fibres, which connect them, and appear to be in some measure nervous.

The particular Structure of each moving Fibre, is not yet sufficiently known. They may all be divided into several Fibulæ; and the Substance of their Fleshy Portion, is believed by some to be cellulous or vesicular, and by others, spongy or medullary. Some of the Ancients imagined this Portion to be concave, and that it contained a Sort of Pulp, called by them Tomentum more or less saturated with Blood. And they compared a Muscle to a Rat, or other Animals fleaed, and divided it into Head, Belly and Tail.

When we examine a moving Fibre through Microscopes, both the fleshy and tendinous Parts of it appear contorted, but the latter not so much as the former. Having injected any coloured  
penetrating

penetrating Liquor, we may, by the Help of a Microscope, discover a very fine and close vascular Texture, which insinuates itself between all the Fibres, covering or being twisted round them, and likewise spread on the Septa.

The fleshy Portion may be contracted or shortened, and relaxed or elongated.

The tendinous Portion yields but very little, resisting any Force tending to prolong it, except it be so violent as to disorder its Texture.

The Disposition of the moving Fibres is different in different Muscles, and their tendinous and fleshy Portions, not always lie in the same strait Line, but make opposite Angles with each other. In some Muscles, the fleshy Portion is not all of the same Length; in others it is nearly equal, but the Fibres unequally and gradually disposed at the Sides of each other, forming all together an oblique Plane.

Some are disposed like Radii, others form Planes, more or less, incurvated; and some complete Circumferences, the two Extremities, meeting and uniting together.

The tendinous Portions, being only the Supplement of the whole Length of the Muscle, may be of equal or unequal Lengths, according to the Disposition of their Insertions. They may be very short at one End of the Muscle, and very long at the other. When the fleshy Plane is partly oblique, they vary gradually in Length, and when that Obliquity is reciprocal, at both Ends, in Form of a Lozenge, the tendinous Portions are alternately long and short.

In some Muscles, each moving Fibre is nearly of the same Length with the Body of the Muscle; in others, the fleshy Fibres are very short, though the Body of the Muscle formed by them,  
be

be very long. In the first Kind, the Fibres, run more or less strait from one End to the other, and are never very numerous.

In the Second, they are situated obliquely, and are consequently in great Numbers; so that the Length of each Fibre, is not always to be measured by that of the Body of the Muscle to which it belongs.

These different Portions of Fibres are not to be met with equally in all Muscles. Some have two or more Tendons, some only one, but of different Lengths; others have none at all, or at least none that can be perceived, as has been already said.

But there is no Muscle without a fleshy Portion, (properly speaking) which alone being capable of Contraction, is absolutely necessary; whereas the Tendons in many Places, are only Productions, by which the Muscles are fixed to Parts at a Distance from them.

Many Muscles are observed to be covered by an aponeurotic Expansion of different Degrees of Strength and Size, which seems to arise from one or more of the neighbouring Tendons.

In Proportion as it is extended, it grows thinner, and then loses itself in the cellular Membrane of the Muscles.

There are likewise strong ligamentary Membranes of another Kind, by which many Muscles, are covered by a Girth. They are composed of several Laminæ, of strong white shining Fibres, crossing each other, and they are strongly fixed along one or more Bones, almost in the same Manner as the inter-ossæous Ligaments of the Fore-Arm and Leg. They furnish Septa or common Vaginæ to the Muscles which they cover, and likewise particular Vaginæ to the Tendons, thinner than those of the fleshy Portions.

These

These common Laminæ and Vaginæ serve to gird and confine the Muscles, and to keep them in their Places in great Efforts. They likewise, in some Measure, supply the Place of Tendons, and multiply the Insertions. The loose Portion of these Membranes are lined on the Inside with other very fine Membranes, which are continually moistened by a mucilaginous Liquor, to preserve the Muscles and Tendons, contiguous to them, from Friction.

Besides these Laminæ and Septa, there are other ligamentary Fræna peculiar to the long Tendons, called by the Name of Annular Ligaments, the general History of which is to be found in the Description of the fresh Bones.

The Difference of Muscles is very considerable, and depends on many Circumstances, the chief of which are the Size, Figure, Direction, Situation, Structure, Connection, and Use; and it is from these Differences that the Names of the greatest Part of the Muscles are taken. From their Size, they are termed Great, Middle, Small, Long, Broad, Thin: From their Figure, Triangular, Scalenous, Square, Rhomboid, Indented, Orbicular, Deltoid: From their Direction, Strait, Oblique, Transverse: From their Situation, Superior, Inferior, External, Internal, Anterior, Posterior, Right, and Left: These four Differences, and the Names derived from them, are easily comprehended; but what relates to the other three, requires a little farther Explication.

With respect to their Structure, Muscles are either simple or compound.

Simple Muscles are those whose fleshy Fibres, or rather the fleshy Portions of their moving Fibres, are all uniformly disposed, and terminate in Tendons, lying either in a strait or oblique Line in the Manner already explained.

Com-

Compound Muscles are those whose fleshy Fibres are disposed obliquely in several particular Ranks, representing the same Number of simple Muscles, with the Fibres lying in opposite Directions. In proportion to the Number of these Ranks or Series, the Muscle is said to be more or less compounded.

When the compound Muscle is formed of two simple Muscles, only, these are so disposed as to represent a Feather, and the compound Muscle is from thence termed Penniform. In some of these Muscles one of the Tendons appears to be slit or divided, in order to contain the fleshy Portion between its two Parts, while the other runs through the Body of the Muscle, diminishing gradually in Size it advances, in the same Manner as we see a Feather. In others, there is only one middle Tendon between the Series of flesh Fibres, which are by their other Extremity fixed to other Parts. In more compound Muscles, the Tendons at one Extremity may all unite together, while those at the other remain divided.

But there are still other Kinds of compound Muscles; some are made up of two, placed endways, and connected together by a common Tendon; so that this Tendon, the two Muscles, and the two Tendons at their Extremities, lie all in a Line, and form the whole Length or Extent of the compound Muscle, which is termed DIGASTRICUS, or BIVENTRIS; and if three Muscles be thus connected, the Compound is called TRIGASTRICUS.

Some are composed of two Muscles more or less in a lateral Situation, with respect to each other, and united at one Extremity; others are composed of three or four Muscles, situated in the same Manner; and if they are united at that Extremity, which the Ancients called the Head of

the Muscle, they are called Bicipites, Tricipites, &c. according to the Number of these Heads; but if they are connected at the other Extremity, they are termed Bicornes, Tricornes, &c.

The Muscles are fixed by their Extremities to different Parts, and in different Places of the Body; the greatest Part of them are inserted in Bones alone. Some are fixed partly to Bones, and partly to Cartilages, as those of the Ear and Nose; some partly to Bones, and partly to the Integuments, as several Muscles of the Face, which may therefore be termed Semi-cutaneous. In some, the Fibres make an entire Circle, without terminating any where by their Extremities; of this Kind are several of those called Sphincters, to which may be added the Heart, Stomach, and Intestines. All the Muscles have likewise a Sort of Connection with the neighbouring Parts, but this is only lateral, by means of Membranes.

The Names, taken from the Connections and Insertions of Muscles, are generally of two Kinds; one Common and referred to some considerable Part of the Body, as when we say the Muscles of the Head, of the Thorax, Abdomen, Arm, Leg, Eye, Lip, &c. The other Proper, specifying more particularly the Insertions of each Muscle, as the Mastoideus, Sterno-Mastoideus, Coraco-Brachialis, Anconeus, Peroneus, &c. Some Names have no Relation to the Insertions, as those of Ulnaris and Radialis, which are given to Muscles which lie upon the Ulna and Radius, without being inserted in either Bone.

The Names of the first Kind relate more to the Uses of Muscles, than to their Insertions, and are, for the most Part, ill founded and apt to mislead us, as will appear when we come to the Uses of the Muscles. The Names of the second kind, are Instructive, and those of the Third are Tolerable.

The



The general Use of the Muscles is to move all the Parts of the Body, whether hard, soft, or fluid. Most of the hard and soft Parts are moved by these Powers being fixed to them, and they move the rest without any such Insertion.

The Muscles fixed by both Extremities to hard Parts reciprocally moveable, may accordingly move either Part. Thus the Muscles inserted by one Extremity to the Os Humeri, and by the other to the Ulna, may move the Ulna upon the Ulna upon the Os Humeri upon the Ulna.

Muscles fixed by one Extremity to hard Parts, and by the other to soft Parts, cannot perform these reciprocal Motions, because, in this Case, the hard Parts must remain immoveable, the soft Parts only being moved, as in the Muscles of the Ball of the Eye, those of the Lips, &c.

The Fluids, of whatever Nature or Consistence they be, are moved in some Cases, by being immediately pushed or projected by the Muscles, as we see in the Heart, in others by their Canals being pressed upon, as in the oblique and transverse Muscles of the Abdomen; and there are other Muscles which stop or retard the Motion of the Fluids at one Time, and facilitate or accelerate it at another, as all the Sphincters.

The Use of each Muscle in particular is confined to the Motion of one or more moveable Parts; some Parts require a certain Number of Muscles to move them, whereof some act one way, and some another. Several Muscles, for Instance, move the Os Humeri upon the Scapula, and of these some raise, others depress it; some turn it anteriorly, some posteriorly, and others round upon its Axis, &c. In like Manner, the Fore-arm is moved upon the Os Humeri, by certain Muscles, whereof some extend it, and others bend it.

The general Enumeration of the Muscles of the human Body, which is commonly made, is founded on their supposed particular Uses. We meet Lists of the Muscles of the Head, of the Thorax, Abdomen, Extremities, Eye, Nose, Lips, &c. and to the different Muscles said to belong to each Part, Names are given, specifying some determinate Uses; such as Raisers, Depressors, Abductors, Adductors, Flexors, Extensors, &c.

This Method of distributing and naming Muscles, is very well suited to the Memory, and may be retained for those that are not entirely, or not at all fixed Bones; but with respect to those Muscles, which are inserted in Bones alone, this way of talking is very capable of misleading Beginners, of begetting false Ideas, of obstructing the Progress of Knowledge, and even of making able Philosophers, Physicians, and Surgeons fall into considerable Mistakes.

It leads us naturally into several Errors, as for Instance; that the Parts to which a certain Number of Muscles is attributed, cannot be moved by other Muscles; that the Muscles said to belong to one Part, can move no other Part; that the Muscles, whose Uses are limited and determined by certain Names, can have no other Uses; and that the Muscles, so named, may have the Uses assigned to them, in all the different Situations of the Parts, to which they are fixed. It is however absolutely necessary, for the sake of Memory, to divide the Muscles into Classes, and afterwards to subdivide each again.

• To shun the Inconveniences already mentioned in the Muscles fixed only to Bones, WINSLOW discards the Names taken from the Parts, to which these Muscles are commonly attributed, from the Uses assigned to them; and retains as much as possible, the usual Names, which express only the Insertions

tions or other Circumstances, that he may avoid all Affectation of Novelty; and when I find myself obliged to change a Name, I set down the common Name, after that which has appeared to me to be more natural and agreeable.

On this Plane it will be necessary to describe separately, all the Muscles which are wholly inserted Bones, and not to explain their Uses, till they have all been described, they being so nearly related to one another, that it is very difficult to speak of the Uses of any one, without mentioning several others.

When several concur nearly in the Motions, they are termed Congeneres, those which act in opposite Directions are relatively and alternately called Antagonists. Thus all the Muscles, which extend or bend the Fore-arm, are Congeneres, and those which extend it, are Antagonists to the Flexors; and these again reciprocally Antagonists to the Extensors.

There must at least be two Muscles to intitle them to the Name of Congeneres, but that of Antagonist may be given to one Muscle as well as to several. Many Muscles contribute to the same Motion, without being Congeners, viz. whereby acting in an oblique Direction, they produce a third Motion, which is direct and determinate. This is termed a combined Motion, and may successively continued continued in different Directions, as that of the Arm in turning a Sling, or the Handle of any heavy Machine. Lastly, When all the Antagonists on every Side or all the Muscles that move a Part, act equally, and keep the Part fixed in a middle Direction, between all the Motions of which it is capable, they are said to be in a Tonic Motion.

To move any Part, or to keep it in a determinate Situation, all the Muscles belonging to it,

must co-operate, some of them drawing the Part directly to the Situation or Attitude designed some moderating this first Motion, by acting in a contrary Direction, and others directing it laterally. The first kind of these Muscles, we call Movers, the second Moderators, and the third Directors.

All these Kinds are to be found in the Articulations by Enarthrosis, and in many of those by Arthrodia. The Director Muscles are wanting in those by Ginglymus, being there unnecessary. The Moderators are in general the same with those termed Antagonists, and the Want of their Action, is in many Cases supplied by the Weight of the Part to which they are fixed, or by the additional Weight or Resistance of some other Body.

The Action of the Muscles in General, or, to speak more properly, the Mechanism of this Action, consists chiefly in the Contraction or shortening of their fleshy Portion, by which the Extremities, of the Muscle are brought nearer to each other, and consequently the Parts are moved, to which these Extremities are fixed. It is, I say, the fleshy Portion alone which is shortened; the Tendons retain always the same Length, and only follow the Motions of the other Part, much in the same Manner, as in drawing a great Weight, by Ropes fixed to it, where the Arm alone is shortened, while the Ropes only follow that Motion.

The principal Phænomena of muscular Action, are these: The fleshy Portions appear harder and more swelled in the Time of Action, than of Inaction, as may be readily perceived by touching it in both States: The Hardness of this Swelling increases, by merely adding to the Weight or Resistance of the Part moved, though its Situation, does not continue to be changed.

In many Muscles, this Action may be determined to any Degree of Velocity and Space; that is, may

may be proportioned to the Velocity and Space of the Motion; may be increased and diminished, accelerated, retarded, or stopped; and may be made to cease in an Instant.

During the Contraction of a Muscle, its Fibres are bent through their whole Length, or formed into very small fine Folds, in alternately opposite Directions, as may be plainly seen in Animals fresh killed, their Flesh while it remains warm, though the Blood has been let out and the Intrals removed. By opening living Animals, and also in great Wounds, the fleshy Fibres have been discovered to grow pale during their Action, and to turn red again when at rest.

To these Phænomena, we must likewise add, that where several Muscles are fixed, to any moveable Part, they are all in a State of Contraction, in every Motion of that Part; but they are not all in the same Degree of Action, because the principal Movers act more than the Moderators and Directors, or collateral Muscles, if any belong to the Part. This Co-operation of Muscles, is easily perceived by touching them, when the Part they belong to, is moved with a considerable Force. It must however be remembered, that I expect the Moderators, or Antagonists, when any Weight or Assistance supplies their Action.

Lastly, There are some Motions, to which the Muscles, commonly believed to produce them, contribute nothing at all, but which depend solely on the Relaxation of the Antagonists to these Muscles, or those that lie on the opposite Side. This is seen evidently in supporting the Body by one Hand resting on a low Table, the Joint of the Elbow, being in that State, suffered to yield to the Weight of the Body, or bend sometimes slow, and sometimes fast; for if we feel with the other Hand the flexor and extensor Muscles of the Fore-

arm, the first will be found perfectly relaxed to determinate Degrees of Velocity and Space, with the same Certainty, as they can be contracted.

The last Phænomena gave me room to conclude, that the Action of the Muscles in general consists as really in the Relaxation of the moving Fibres when contracted, as in the Contraction of them, when relaxed, whether the Action be performed successively or instantaneously; and it was for this Reason, that when I began to speak of the Action of the Muscles, I did not absolutely say, that it consisted in the Contraction of the fleshy Portion, but only that it was principally owing thereto. I do not here speak of those Motions, that are out of our Power, and which we can determine only in Part; as those of Respiration; or not at all, as that of the Heart.

The particular Mechanism, or immediate Cause of muscular Action, has very much tortured the Brains of many Philosophers.

The extreme Delicacy of the Texture of a moving Fibre, and a great Number of Phænomena, some of them very obvious, which have not been attended to, have hitherto prevented the Discovery of this Mystery. Several Hypotheses have been formed concerning the Structure of this Fibre, which, as already said, has been supposed spongy, vascular, vesicular, contorted, elastic, &c. and concerning the Concurrence of different Fluids, with the supposed Structure of the Fibre Systems have even been founded wholly on the Spring or Elasticity of the solid Parts of which a Muscle is composed.

But by considering attentively the Phænomena already mentioned, especially the first three concerning the Velocity, Space, and Duration of muscular Action, all these Systems may be destroyed. For hitherto no Instance can be found either in  
natural

natural Effects, or in those of Art, of any Explosion, Fermentation, Ebullition, Injection, Inflation, Imbibition, Vibration, Elasticity, &c. by which we can regulate and determine, to a given Degree, the Space, Velocity, and Duration of any artificial Motion ; or by which we can put an End in an Instant of Time at our Pleasure. It is therefore altogether to no Purpose, to amuse ourselves with what has been said on this Subject : Another Method must be followed, which consists in collecting and examining all the Phænomena, that can fall under our Observation.

Till some lucky Discovery is made, what can hitherto with the greatest Certainty be gathered from the Structure, Confirmation, and Action of the Muscles, is, that their Strength depends on the Number of their fleshy Fibres, and the Extent of their Action on the Length of these Fibres.

For wherever Strength is more necessary than large Degrees of Motion, there we find the Fibres of Muscles proportionably increased in Number, and that their Situation, in a narrow Compass, is artfully provided for, by the oblique Disposition of them already mentioned. In like Manner, wherever there is more Occasion, for a large Degree of Motion than for Strength, the fleshy Fibres are of a proportionable Length. In a Word, the Strength of a Muscle is as the Number of its fleshy Fibres, and the Extent of its Motion, as the Length of these Fibres.

To understand the Uses and Contrivance of each Muscle in particular, we must consider attentively its Place or Situation in general, its external Conformation, Insertions, particular Situation, Direction, lateral Connexion, Relation and Composition of its Parts. We ought likewise to examine how the circumjacent Muscles are disposed

for producing simple Motions, and how those that are at a greater Distance, can produce combined and compound Motions.

It ought moreover to be observed that in some Subjects, the Muscles vary, some being wanting, and others added in different Manners, so that we ought to regulate ourselves by what happens most frequently, and universally, that we may not render the common Cases obscure, for the sake of a few that are extraordinary, and which ought to be considered in the same Light as we do the Instances of six Fingers, eleven Ribs, and other *lusa naturæ* of the like Kind.

Muscles fixed only to Bones act as so many Powers, applied to Levers ;

By a Lever we understand a long inflexible Body, like a Rod or Bar, by the Help of which, we raise Weights and overcome Resistances, which it would be more difficult or impossible to do with the Hand alone.

A Lever, in order to act, is applied to the different Things, at three different Places of its Length, viz.

At one Place to the Weight or resisting Body ; at a Second, by the Power with which it acts ; and at a Third to a Fulcrum, which, with respect to the other two, ought to be immoveable ; so that the whole Length of the Lever, is as it were divided by three Points ; which may be termed the Point of Resistance, and that of Power.

These three Points may be disposed, in three different Manners ; First the fixed Power may lie between the Point and the Weight, as when the Stone-cutters and Paviers, raise or move Stones with Iron Crows. Second, the Weight may lie between the Power and the Fulcrum, as when Masons move large Stones, by applying Crows to them, somewhere near the Middle. Third, The  
Power



Power may lie between the Weight and Fulcrum, as when Braziers scrape Copper, in order to tin it, by laying one End of the Scraper on their Shoulder, the other on the Metal, and holding the Middle in their Hands.

From these three Dispositions, three different Kinds of Levers, have been established. In the First, the Fulcrum, or fixed Point is in the Middle; in the Second, the Weight; and in the Third the Power.

In the Actions of Levers, the following Maxims are to be observed as so many general Rules.

The greater Distance, of the Line of Direction, of the Power from the Fulcrum, less Force is necessary to overcome the Resistance.

The nearer that this Line of Direction is to the Fulcrum, more Force is necessary to overcome the Resistance, or raise the Weight.

When the Line of Direction of the Power passes through the fixed Point; and consequently falls in with the Direction of the Lever, the Power can produce no Effect, WINSLOW.

\* In order to the easier Illustration of this wonderful and important Property in the Fibres, I shall give you, 1st, An analytical View of the component Parts of a Muscle. 2dly, I shall shew the true Cause of Cohesion, Tension, and Elasticity in the animal Fibres. 3dly, I shall make it appear, that every Fibre constituting a Muscle, is, in its ultimate Division, tubular, and not a Chain of Vesicles or

\* This and the following Lecture, was wrote by the late ingenious Dr. BROWNE LANGRISH, Fellow of the Royal Society; and as the Croonean Lectures on the Muscular Motion by Order of the President and Council read before the Royal Society, 1747.

I thought it would not be disagreeable to the Reader to have them inserted at Length, being so philosophically penned, on the most probable Conjectures, as can be expected upon so obscure a Subject as this,

Bladders. And, Lastly, I shall prove it more than probable, that muscular Motion proceeds from the attractive Quality of the constituent Particles of every Fibre being increased and strengthened by the Addition of some æthereal Matter flying out from the Extremities of the Nerves; and that this is instantly occasioned by the Will, and ceases again as soon.

By a chemical Analysis of a Muscle dissected from the Buttock of a lean Ox, which weighed exactly two Pounds Averdupois, I procured,

	Oz.	Dr.	Gr.
1. Lymph —————	24	14	15
2. Volatile Salt ———	1	4	25
3. Oil ————— ———	2	6	20
4. Caput mortuum ———	2	9	5
5. Lost in Distillation, which I } presume was mostly mere Air }	—	12	16
	32	00	00

There being no Averdupois Weights in the Shops, less than Quarters of Ounces, I ordered some to be made of a Drachm, and others of two Drachms. The Drachm weighed 27 Grains; so that, by casting up the Grains into Drachms, and the Drachms into Ounces, we have the exact Weight of each of the above constituent Principles according to the Weight they were first of all weighed with.

It may be proper also to observe, that the Apparatus I made use of in this Process, was the same which I communicated a Description of to the Royal Society some time ago, and which is since published in the Philosophical Transactions, N<sup>o</sup> 475; except that the Retort I now used was made of Copper, in order that I might remove it from the Sand-Heat

Heat into the actual Fire, without unluting any Part of the Apparatus, when no more Matter would arise by means of the Sand-Heat.

By this Method I could increase the Fire till the Bottom of the Retort was red-hot, without any Danger of breaking my Recipients; a Contrivance which may be useful in many chemical Processes.

From the above-mentioned Experiment we have evident Proof of the Proportions and Qualities of the several Principles, or constitutive Parts of the muscular Fibres; and let no one be surpris'd that watery or phlegmatic Principle abounds so much as to be nearly  $\frac{1}{3}$  Parts of the whole Mass, since we know that dried Bones, and many other Things as unpromising, affords half their Weight of Water.

That the Particles of Water are endued with a strongly attracting Power, and are highly serviceable as a Band of Unions in the Formation and Growth of Animals and Vegetables, but also in our own manual Operations, such as making several Sorts of Glue, Pastes, Bricks, and such like, where the watery Particles prove a very durable and powerful Copula, and are not to be all of them separated again, even by a very intense Fire: Water is to be regenerated from Bricks and Tiles after they have been burnt in a Kiln.

The driest Wood, Part of a Mahogany-Table, which had stood by the Fire many Years, being rasped and put over the Fire in a Copper Retort, afforded a considerable Quantity of Water.

In short, take away the Water from the most solid animal and vegetable Bodies, and they immediately become mere Dust.

I don't apprehend that this considerable Quantity of Water, which is to be procured from such solid Substances as Bricks, Wood, or even from the muscular Fibres, remains in distinct Drops or Spherules,

Spherules, whilst it is a Part of such solid Substances ; but I conceive that the Minima, or primary solid Particles of Water may be attracted by, and actually joined with, the earthy, saline, and other component Particles, so as to compose the several Degrees of Hardness, according to their respective Proportions and Qualities ; and when these several constituent Principles are disunited again, by the Power of Fire, or by the Length of Time, they rise up into the Air, or into the Recipient, according to their Divisibility and Levity ; first Water, next Salt, then Oil.

Nature seems to delight in Transmutations. Many Kinds of Fluids are easily converted into dense Bodies. We all know how soon Water is capable of being turned into a very solid friable Stone, by the Power of Cold. Mercury also is easily turned into a hard brittle Metal ; and both these return to their former State of Fluidity by means of Heat. And a Solution of Copper in Spirit of Nitre being poured on Oil of Tartar, both Liquids instantly become Verdigrease in a dry Powder.

From what has been said we may observe, that Water, or the aqueous Particles not only make up much the greatest Part of the muscular Fibres, but, by mutually attracting, and being attracted by the other component Particles, they greatly contribute towards their Cohesion and Elasticity ; for a fluid Particle will be fixed, and become a Part of a Solid, as soon as there is an attractive Force sufficient to effect its Cohesion with other solid Parts, though it returns to its former State of Fluidity upon the Analysis of the compound Body.

I would not by this be understood as if I designed to exclude the other Principles from their Participations which they give to the true Degree of Firmness and Elasticity in the Fibres ; the saline, sulphureous, and earthy Parts are all endued with a strongly

ly attracting Power ; and when brought into Contact with each other, or with the watery and aerial Particles, they give Firmness and Solitude to the Composition.

Water seems to be the Gluten by which the other Principles are wrought up. Too much Water in the Composition renders the Fibres soft and lax ; as in Children, and anasaruous People. Too little Moisture occasions a stiff, rigid Fibre ; as in old Age. There is a certain Degree of Texture and Cohesion necessary towards muscular Motion in its greatest Strength.

I have shewn in a former Treatise\*, that Air is very instrumental in fixing and uniting the other Principles which constitute an animal Fibre ; for in the most solid Parts of the Body, where the Cohesion is strongest, we find great Plenty of Air. That the airy Particles are capable of being united, and fixed to solid Bodies, and by that means may be esteemed a Part of their Composition, we have many evident Proofs in Dr. HALE's Analysis of the Air ; and that those Particles do in their fixed State strongly attract the other component Particles is evident, it being well known, that the most strongly repelling and elastic Particles when in a separate State, are the most strongly attracting, when fixed to other Bodies.

Now, according to Dr. HALE, since a much greater Proportion of Air is found in the solid than in the fluid Parts of Bodies ; may we not with good Reason conclude, that is very instrumental, as a Band of Union in those Bodies ; those Particles (as Sir ISAAC NEWTON observes†) receding from one another with the greatest repulsive Force, and being most difficultly brought together, which upon

\* Modern Theory of Physic, p. 56.

† Opt. Qu. 31.

Contract cohere most strongly? And if the Attraction or Cohesion of an unelastic Air Particle be proportionable to its repulsive Force in an elastic State, then since its elastic Force is found to be vastly great, so great also must be that of its Cohesion. Let us add to this, that the Air generated from the fleshy Fibres, in the Experiment above-mentioned, was not separated without great Violence; for it did not rise in any Quantity, till the Clouds did, which contained and brought over the Salt and Oil: Whence it is evident that the aerial Particles are firmly fixed, and consequently are very instrumental in the Union of the other constituent Principles.

Sir ISAAC NEWTON \* thinks that not only Water and Air are convertible into dense Bodies, but that even Light may become a Part of gross Bodies, and that they may receive much of their Activity from the Particles of Light which enter their Composition. It is the Opinion also of Mons. HOMBERG, that Light or Fire is a Part of the Composition of all Things; though in the Analysis of Bodies it is always lost, escaping the Skill of the Artist, and passing through the closest Vessels.

These then being the component Parts of the muscular Fibres, our next Task is to shew the Cause of their Tension and Elasticity.

That all the muscular Fibres of the Body are in a State of Tension, during Health, is manifest from every Incision made across them, when the two Segments of the Muscle so divided, retire, one to its Insertion, and the other to its Origination; that is, every Fibre is always stretched out beyond its natural State of Rest or Quiescence, so

---

\* Opt. Qu. 30.

that both Ends of it retract a considerable Distance after being cut asunder. Now there are two Things which seem to be principally concerned in this Affair ; viz. the Impulse and Pressure of the circulating Fluids, always distracting the Fibres, and a constant Nisus or Endeavour in the constituent Particles of the Fibres to run closer together, when so destined, by means of their mutual Attraction towards each other.

The Equilibration which is ever preserved between the antagonist Muscles, in a healthy State, unless when the Will directs it otherwise, arises from this Vis Restitutiois ; which being stronger or weaker, according to the Degrees of Tension, and the Degrees of Tension depending upon the Velocity and Quantity of Fluids circulating through every Fibre ; it follows, that as long as the Fluids have the same free Access to every voluntary Muscle, so long will the Equilibrium be maintained.

When any saline Liquor (says he) is evaporated to a Cuticle, and let cool, the Salt concretes in regular Figures ; which argues, that the Particles of the Salt, before they concreted, floated in the Liquor, at equal Distances, in Rank and File ; and by Consequence, that they acted upon one another by some Power, which at equal Distances is equal, at unequal Distances is unequal : For, by such a Power, they will range themselves uniformly, and without it they will float irregularly. And since the Particles of Iceland Chrystal act all the same Way upon the Rays of Light, for causing the unusual Refraction, may it not be supposed, that in the Formation of this Chrystal, the Particles not only ranged themselves in Rank and File for concreting in regular Figures, but also, by some kind of polar Virtue, turned their homogeneal Sides the same Way ?

And

And again, we are taught by the same great Man, that Fire is the most simple of all known Bodies, and consequently the most immutable; that each Ray of Fire or Light has Sides differently affected, and which have different Properties; and that Iceland Chrystal is found to attract a Corpuscle of Fire, if one of its Sides be turned towards the Chrystal, and repel it, if the other be; for one and the same Ray is here refracted sometimes after the usual, and sometimes after the unusual manner, according to the Position which its Sides have to the Chrystal; and since the Chrystal, by this Disposition or Virtue, does not act upon the Rays, unless when one of their Sides of unusual Refraction looks towards that Coast, this argues a Virtue or Disposition in those Sides of the Rays, which answers to, and sympathises with, that Virtue or Disposition of the Chrystal, as the Poles of two Magnets answer to one another.

We are fully persuaded, that, in the ChrySTALLI-fication of Salts, they could not so regularly and constantly preserve their peculiar Shapes, Forms, and Figures, if every Particle of them had not its determinate Poles: For granting that the component Particles of each kind of Salt, have a peculiar Shape and Size, different from any other kind of Salt, yet if they had a Power of uniting with each other indifferently, at their Tops, Sides, and Bottoms, one would think they could not always coalesce into Chrystals of the same regular Figure: But if the constituent Particles of every kind of Salt have their determinate Poles, then they cannot possibly unite with each other, but when their Poles square with one another, consequently, they will always fly together, and be joined at such Points, only where their corresponding Poles are; which must of course constantly  
produce



produce the same regular Form and Figure in every Aggregate of such particular saline Particles.

Hence it is, that Salt Ammoniac so elegantly imitates the Branches of a Tree; Salt of Hartshorn a Quiver of Arrows; Salt of Tin shoots into Lines like little Needles, which spread themselves every Way from a Point, as a Centre, so as to represent a Star, &c. Now can it be imagined that these, or any other kind of Salts, would immutably and perpetually coalesce into Chrystals of the same regular Figure and Shape from any other Principle?

Since therefore we have so much Reason to believe that Salts of all kinds, and even the Rays of Light are endued with a polar Virtue, that is, every Corpuscle attracts on one of its Sides, and repels on the other; and since it is well known Axiom, that Nature is ever frugal in Principles, I think it not at all unphilosophical, or contrary to any of the known Laws of Nature, to believe that every Particle of Matter in the World is endued with an attractive and repulsive Property.

Thus then, if the constituent Corpuscles of the muscular Fibres are formed together according to this Law, if they are all united at particular Points corresponding to their attractive Virtue; it follows, that wherever a muscular Fibre is stretched out to the least Degree of Tension, some of its Particles will touch each other in fewer Points; whilst others may possibly be disunited and removed from each other, though perhaps to inconceivable small Distances: Hence there will be a constant Nisus in the separated Particles to get together again; and this Vis Restitutionis will be stronger or weaker, according to the Number of Corpuscles so disjoined, and their attractive Virtue.

If the Power of circulating Fluids (and I think it cannot be denied) be sufficient, from the first Be-

ginning of the Circulation of the Fœtus, and so on as long as Life continues, to distend the Fibres beyond the Size they would otherwise be of, by reason of their corpuscular Attraction; this distrac-tile Power must always be the Occasion of some Degree of Tension in them: And if, upon the Removal of this Tension, the component Particles have a Property of running closer together, and contracting the Fibres in their Length, by the means above mentioned, this must be the true Cause of Elasticity in the Fibres.

Hence therefore it follows, that since the Fibres are always in a State of Distraction, by the Quantity and Momentum of the circulating Fluids, and as they are ever endeavouring to shorten themselves, by means of their corpuscular Attraction, their Elasticity must depend upon Tension; for the Fibres could have no Power to retract, or abbreviate their Length, unless they were extended beforehand by some certain Force.

It is not a sufficient Objection against this Scheme to say, that if we depend upon what is visible, we shall never see the dry solid Fibres, or Particles of any solid Body, once divided or drawn out of Contact, coalesce or unite again, or recover the close Contacts they had before; without some fluid Medium superadded.

'Tis true, when a visible Crack or Flaw happens in any dry, hard, solid Body, such as a Steel-Spring, or a dry, rigid, wooden Bow, the Rupture will always continue, by reason the severed Particles cannot be brought again into the Sphere of each other's Attraction without the Intervention of some Medium; but then it does not follow from hence, that such a Spring or Bow cannot be bent at all without breaking; or that the constituent Particles, which must necessarily be displaced by such a dis-tending Power, do not fly together again by their attractive

attractive Virtue, when removed only to such minute Distances.

The Minima, or primary Atoms of all Bodies are non-elastic, as being perfectly hard, solid, and inseparable; and therefore Elasticity must proceed from the Aggregate, or Composition of such Atoms, which, by being capable of changing their Situations, according to the impressed Force, and being endued with a powerful attracting Virtue, they instantly resume their former Positions, when left to themselves to obey those Laws which the great Creator hath impressed upon them. As for Instance: Whilst a common Steel Spring, or any such elastic Body, is not extended or bent, we presume every individual Particle of it to be at Rest; that is, they are all situated, in regard to each other, according to their Poles, and embrace one another by their common Principle of Attraction; but no sooner is such a Spring bent, by some impressed Force, but many of its Particles on the convex Side, must of course touch in fewer Points, or perhaps be disunited from each other, though to the most minute Distances that can possibly be; whilst other Particles, on the concave Side of the Spring, must necessarily slip upon, or be crowded over one another. Hence it will follow, that if those Particles which are separated from each other, or touch one another in fewer Points than usual, are yet so near each other as to be within their Sphere of Attraction, and not at all, or very little altered in regard to their Poles, they will consequently attract each other very strongly, and fly together again, as soon the as impressed Force is removed; whereas it is no unreasonable Conjecture to suppose, that those Particles on the concave Side of the Spring, which are compressed, and as it were rumpled over one another, may be so much altered from their former Positions, that their Poles do

not now answer to each other; and if not, they will repel one another, according to their respective Powers, till they have attained their former Situations, or, in other Words, till the Spring has recovered its former Shape.

The same Principles of Attraction and Repulsion are the Cause of Restitution or Elasticity in all other kind of Bodies. When a muscular Fibre is stretched out longer than usual, it is most certain that some of its component Particles must slip upon or by one another, or removed at exceeding small Distances from each other; so that if the impressed Force be too violent, if the Tension be carried so far as to disunit a great Number of the component Particles beyond their Sphere of Attraction, the Fibre will continue to grow weaker and weaker till it breaks: But it is as evident, on the other Side, that when a stretched-out Fibre does not break, but retracts itself into its former Shape and Dimensions upon the Removal of the extending Power, the Particles which were displaced return again to their proper Positions, merely by the means of their attractive Virtue.

Now all this being so agreeable to those Laws of Nature which that divine Man Sir ISAAC NEWTON has discovered to us, I think we have good Reason to conclude it to be the true Cause of Elasticity in the animal Fibres.

The Elasticity in the Air indeed, or in Water agitated by Fire, or in all the Exhalations, and Air, stand at a Distance from one another, and endeavour to recede as far from one another as the Pressure of the incumbent Atmosphere will admit them. No Power yet known is able to compress the Air-Particles within the Sphere of their elastic Property; and yet single primary Particles of Air are continually attracted by other Bodies, and consolidated with them, till by the Action of Fire,

or

or Fermentation, they are separated again, and restored to their repulsive State.

Hence we may observe, that Elasticity, in different kinds of Things, or in Matter differently modified, may arise from two several Causes, viz. Attraction and Repulsion; and perhaps, in many Instances, from the Influence of both at one and the same time.

Whenever any kind of Matter is actuated by Fire, by Fermentation, or dissolved by any Menstrum, so as to throw off its Particles in subtle Vapour, there will be a constant Endeavour in those Particles to recede further from each other; so that the more they are confined, or compressed, the greater will be the elastic Power: Whereas in solid Bodies, this Property of Elasticity proceeds chiefly from Attraction, or a Nisus in the component Particles to fly back, or run into close Contracts again, whenever they happen to be stretched out, or bent, so as to touch each other in fewer Points.

From what has been said, we may deduce the following Corollary, viz. That whenever Elasticity proceeds from the Principle of Repulsion, as it does in Air, Vapours, &c. some Compression is necessary, in order to force the elastic Matter into a narrower Compass than it would otherwise possess; but when it arises from Attraction, as in the muscular Fibres, and all solid Bodies, some distractile Force is requisite to disjoin the component Particles from their usual Contracts, before it can exert its Power; and perhaps, for want of attending to this Difference, so many various Opinions may have risen concerning the Cause of Elasticity.

In my next Lecture, I shall consider the Shape of the muscular Fibres, and the Cause of muscular Action.



## LECTURE XV.

### Of the MUSCULAR ACTIONS.

**I**N my former Lecture, I endeavoured to explore the several constituent Principles of the muscular Fibres, and to shew the true Cause of their Cohesion, Tension, and Elasticity. In this, I hope, I shall make it appear, 1st, That every Fibre constituting a Muscle is tubular, and of a cylindrical Shape, or very nearly such; and not a String, or Chain of Bladders, according to an Hypothesis which has been too long and too generally received. 2dly, That the corpuscular Attraction between the component Particles of the Fibres is so far increased and strengthened by the Influence of the nervous Æther, which is always at the Command of the Will, as to purse up and shorten every Fibre in its Length, whereby an Intumescence arises in the Middle of the Muscle, though it is contracted in its other Dimensions, so as, in the whole, to possess less Room.

Being favoured with the Use of a most excellent Microscope, I made the following Experiments.

1st, I divided some Fibres as minutely as I possibly could, from the Heart of an Ox, from a Part of the Diaphragm, from the intercostal Muscles, and

---

\* Read before the Royal Society March 26, 1747.

from a Rump of Beef; all which were boiled to such a Degree of Tenderneſs, that we ſeparated ſome Fibres with the Point of a Needle, which were not viſible till placed under a Microſcope, and even then they did not appear bigger than Hairs though others, which looked like Hairs to the naked Eye, were magnified to the Size of Wheat-Straws. All theſe ſeemed to be Faſciculi of continued Tubes, as far as we could view them, without any Partitions or Cells.

2dly, Upon rendering a Muſcle, which was taken from a Knuckle of Veal, and boiled for four or five Hours ſeveral of the tranſverſe, as well as longitudinal Fibres appeared very diſtinctly; which being placed under the Microſcope, and having a ſtrong focal Light caſt upon them by means of a Florence Flaſk fill'd with Water, they ſeemed to be ſhrunk up, either by being boiled ſo long, or by being expoſed to the Air, ſo that their Surfaces ſeemed to be unequal and corrugated; which is what LEWENHOEK \* ſays deceived him at firſt, ſo as to make him think theſe Corrugations were ſo many Veſicles or Cells; but he ſoon diſcovered his Miſtake. In ſome of the Fibres I could plainly diſcern a dark Liſt running in the Centre, from one End to the other; but what it was, I could not diſcover.

3dly, Having obſerved the muſcular Fibres in the Leg of a Sea-Crab to divide very eaſily and diſtinctly from one End of the Muſcle to the other; we placed a great many of them under the Microſcope, but could not diſcern any thing like Partitions or Cells.

In ſhort, LEWENHOEK † affures us, that the minuteſt Fibres that are viſible to the naked

\* Anatom. & Contempl. p. 43. † Phil. Tranſ. N<sup>o</sup> 367.

## 328 Of the Muscular Actions. Lect. xv.

Eye appear through a good Microscope to be invested with a Membrane, which includes within it not one simple Body, but a Bundle of still finer Fibres, the last, or smallest Order of which he thinks to be simple Tubuli.

This perhaps is as good Authority as we can have from the Assistance of Microscopes; but if we may be allowed to deduce our Arguments from the Analogy which the muscular Fibres bear to some other Parts of the Body, whose Shapes we are well acquainted with, the Reasonableness of this Opinion may appear yet stronger.

All Anatomists agree, that the muscular Fibres have their Rise from the Extremities of the Nerves and sanguiferous Vessels; every Fibre being supplied by a Branch of a Nerve, and an Artery, and having also a Vein arising from it.

That the nervous Capillamenta are Cylinders is not denied by any one that I know of; and though the Arteries have been for a great while thought to be conical, yet the ingenious Dr. JOHN STEPHENSON, \* Fellow of the Royal College of Physicians at Edinburgh, hath evidently demonstrated the whole arterial System to be Cylinders, frequently divided and subdivided, still terminating in Numbers of Cylinders, the Aggregate of which is always of greater Capacity than the Trunk or larger Cylinder before the Ramification.

May we not therefore very reasonably believe, from the Simplicity and Uniformity in all the Operations of Nature, that the muscular Fibres partake of the same Figure with those from whence they have their Rise; especially when such a Shape (as will appear in the Sequel) is more proper for all the Functions of a Muscle than any other whatsoever?

---

\* Medical Essays, Vol. vi.



## Lect. xv. Of the Muscular Actions. 329

I do not mean by this, that every Fibre of every Muscle is a perfect and regular Cylinder from one End to the other ; many of them may be thicker in their Tunics and larger in their Bores about the Middle, than towards each End, similar to the Shape of the Muscle ; but what I think the most reasonable Opinion is, that the smallest Fibrillæ are Tubuli not divided into an infinite Number of Cells or Vesicles.

The longitudinal, red, fleshy Fibres seem indeed to be contorted and bound about in many Places, with white, spiral, and transverse Ramifications of the Nerves ; but I can see no Reason to believe that these nervous Filaments divide the longitudinal fleshy Fibres into several Apartments or Cells ; I rather think that they only dip into the Cavities of the Fibres, in order to convey into them the æthereal Medium, which is contained in the Nerves.

Before the Laws of Nature, and the Animal Oeconomy were so well known as they are now, I do not wonder that the vesicular Opinion was thought a reasonable one, till it came to be examined by strict Rules and Experiments. The common Experiment of raising Weights by blowing up Bladders might seem, at first Sight, a very feasible Way of explaining muscular Motion ; and without Doubt this first of all gave Birth to the vesicular Hypothesis.

But the Fallacy of this Experiment was not discovered for want of attending to the Difference between Bladders which have been already blown up and dried, and such as are recent and supple.

If a String of dry Bladders, which have been once distended as far as they could bear without bursting, and are now again squeezed close, and stretched out only in their Length, by means of a Weight hung at their Bottom ; I say, if such a  
String

String of Bladders be blown up, it will undoubtedly distend their transverse Diameters so as to raise up the Weight: But in all tender yielding Vesicles, such as the muscular Fibres most certainly are, in their last, or smallest Order, it is well known, that if they were to be inflated with Air, or any such-like Matter, it would distend them in every Direction alike; they would grow longer as well as wider. Hence it follows, that if the abovementioned Experiment was to be made with Bladders just as they are taken out of animal Bodies, it would not answer the Purpose, as is evident from blowing up those of Calves, Hogs, &c.

The muscular Fibres, it is true, are always in a State of Tension, but then this Tension is very far from being to their utmost Stretch; so that, were they to be inflated in the manner above-mentioned, every Muscle would necessarily increase in Length as well as Breadth.

Another insuperable Difficulty belonging to the vesicular Hypothesis, is how to blow up a Bladder open at both Ends; which every Vesicle is supposed to be, by having a free Communication with the Blood-vessels.

Having therefore so much Reason to conclude, that the muscular Fibres, in their ultimate Divisions, are not cellular but tubular, let us proceed to shew the Manner and Cause of their Contraction.

#### A MUSCLE IN ITS ACTION VERY EVIDENTLY GROWS LESS IN BULK.

This Proposition is clearly demonstrated by that famous Experiment communicated to the Royal Society, by Dr. GODDARD\* in the Year 1669,

---

\* Vid. Register of the Royal Society, Vol. IV. p. 95.

## Lect. xv. Of the Muscular Actions. 331

where, putting a Man's Arm into a Glass Cylinder full of Water, the Water always sunk when the Muscles of the Arm were contracted, and rise again to the first Standard when they were relaxed: This we think may be looked upon as an Experimentum Crucis; whereas, if every Fibre was a Chain of Bladders, whose Contraction in Length arose from their Inflation in Breadth, all the World knows there would be a sensible Swell of the whole Arm upon muscular Action.

There are still other Difficulties attending the vesicular Hypothesis. If the animal Spirits are supposed to inflate the Cavities of the muscular Fibres merely by a propulsive Force, like unto the Steam of boiling Water working in the Engine to raise Water by Fire, it ought to be proved from whence so strong an Impulse should arise; and also how the Nerves, which are the Conduits thro' which this flatulent Matter must be conveyed, should lie so loose and unelastic; it being evident from all Experience, that if such an elastic flatulent Vapour was to fly thro' the whole Length of the Nerves, with an Energy sufficient to give a Man a Power of lifting up great Weights, the Nerves must be stretched out in Proportion, and consequently would be very tense and elastic.

Those who suppose the Inflation of the Muscles to arise from a fermentative Motion in the Fluids, ought to prove, by a proper Number of Experiments, that there are Juices existing in the Body capable of such sudden and violent Rarefactions or Explosions, upon mixing with each other; and if this possibly could be done, the Diminution of the Bulk of the Muscles in Action, would overturn all their Scheme.

Hence it is evident that the vesicular Hypothesis ought to be entirely rejected, as being repugnant to the Laws of Matter, and to the Phænomena of the Muscles.

By

## 332 Of the Muscular Actions. Lect. xv.

By undoubted Experiments we are convinced, that the Intumescence of a Muscle, when it acts, arises merely from a Change made in its Figure; that is, as it shortens in Length, the Belly grows thicker, and yet the Bulk in general is diminished. Let us therefore inquire after the Agents which are capable of producing such surprising Phænomena, and at the same time shall be consistent with every other Operation in the Animal Oeconomy.

From what has been said it appears, that Contraction, or muscular Action, does not depend upon any Fluid dilating or distending the Fibres; but, on the contrary, they shrink up and grow less. The instantaneous Alternations from Constriction to Dilatation, and vice versa, manifestly discover that muscular Motion cannot be caused by such Juices as the Blood, Lymph, and such-like; but it must be from some more suitable ætherial Matter, which may be mixed with the Blood in general, and secreted from it by the Glands of the Brain.

Let us but carefully consider the exquisite Apparatus of the Brain, the Quantity of Blood it receives, the infinite Number of its excretory Ducts, and the great Divisibility and Subtility of Matter, and we shall find great Reason to conclude that there is a most subtil, æthereal, volatile Fluid, of great Force and Elasticity, perpetually secreted from the Blood, by the Glands of the Brain, and continually flying into the Nerves, for the Uses of muscular Motion, and many other great Purposes of the Animal Oeconomy.

The delicate Texture of the Nerves, as well as that of the Brain, implies that the Fluid they convey to the Muscles must be exquisitely fine. Indeed when a Nerve is wounded, there flows from it a sweet, soft, clammy, balsamic Juice, which no doubt is carried, at all other times, by the eva-  
it

rescent Nerves to their ultimate Divisions, in order to nourish and preserve the most minute Fibrillæ, and all their Expansions ; and this may properly be called Succus nutritius of the Nerves. But I cannot conceive that this visible Juice has any thing to do with the immediate Cause of voluntary Motion ; for so viscous a Matter could never admit of such sudden Vicissitudes, as are in muscular Action, if it was capable of performing it in other Respects.

There are Abundance of Considerations which evince the Existence of some subtle Spirit in the Nerves, much finer than to be the Object of our Senses. We have no Proof, either from Experiment or Reason, of any other instrumental or physical Cause of Sense or Motion, but this animal Æther which is elaborated from the Blood.

The learned Dr. MEAD\* thinks no Regard ought to be had to the immechanical Notions of those Authors, who imagine that there is no such thing as a nervous Fluid in an animal Body ; and that muscular Motion and Sensation are performed only by the Vibrations of the Fibres of the Nerves, without the Intervention of any spirituous Fluid.

The surprising Discoveries which have been made of late Years, by a Variety of Experiments upon Electricity, do in some measure give us an Idea of the great Subtilty and Velocity of the nervous Fluid. I have been informed by the ingenious Mr. WATSON, a worthy Member of the Royal Society, that the Swiftness of the electrical Effluvia is prodigious ; that one Stroke of his Hand down the Tube, when well electrified, was felt as soon as his Hand could be at the Bottom of the Tube, through five Men standing upon electrical

---

\* Introduction to his Essays on Poisons, Edit. iii.

Cakes, and communicating with each other by a Cane, Sword, or any other Non-electric.

Hence it follows, that if a Tube could be always excited, and was always to be applied to the End of a proper Cord or String; the electric Matter, which is excited by Friction between the Hand and Tube, would ever be ready to exert its attractive Influence on Leaf-Gold, and such like Things, when placed within a due Distance of the End of the String; and perhaps this may be very similar to the Motion and Action of the nervous Æther.

Thus much being premised, and it being taken for granted, that we have an æthereal Medium in the Brain, Spinal Marrow, and all the Capillamenta of the Nerves, ever ready to be conveyed into the muscular Fibres, by the Power of the Will, and which Medium consisting of the most refined Matter in Nature; it follows, that the Motion of this nervous Æther may be as quick as Lightning, and also its attractive Power must be exceeding strong, by virtue of its vast Degree of Subtily; as is evident from what Sir ISAAC NEWTON\* has calculated concerning the Rays of Light.

From these Observations therefore, and from what has been said above, concerning the Cohesion and Elasticity of the animal Fibres, I think we have great Reason to conclude, that muscular Motion does proceed from the Influence which the nervous Æther has upon the component Particles of the muscular Fibres themselves, by instantly increasing their attractive Virtue towards each, so as to make them run closer together, or, as it were, up into Heaps, as long as such an additional attractive Medium is in the Fibres.

---

\* Opt. Qu. 23, 24.

If we look back and consider the Nature of the *Vis Restitutio*nis, or Elasticity in the muscular Fibres, we shall find, that the Property only wants to be increased, in order to overcome the distractile Force of the circulating Fluids, and the Resistance of the antagonist Muscles: Whence it follows, that if such a Power was to be increased in one Set of Muscles, and not in their Antagonists, those Muscles, whose elastic or retracting Power was increased, would be abbreviated in their Length, whilst the others would be extended and lengthened.

When any Muscle is freed from the Power of its Antagonist by a Section, &c. it immediately contracts, and is not to be extended again by the Power of the Will. Whence it has been said, that Contraction is the proper State of the Muscles, and to which they always tend: But if we narrowly inspect into this Affair, we shall find, that, when a Muscle is contracted in this manner, it is no farther so than the elastic restitutive Property in the Fibres is concerned. We do not find that such a Muscle is indurated, or its Belly swoln like unto what it is in voluntary Action; for here being no Influx of the nervous *Æther* to increase the corpuscular Attraction, the Muscle is shortened only by the inherent mutual Attraction between the constituent Particles of its Fibres, without any Matter being superadded. This kind of contraction therefore is evidently the State to which the elastic Fibres tends by a continual *Conatus* in the component Particles to accede towards each other without the Assistance of the nervous *Æther*; so that this natural *Vis Motrix* in the muscular Fibres is no more than what we mean by their Elasticity, or restitutive Property: It seems, however, to be demonstrated from hence, that muscular Action and Elasticity in the Fibres,  
 proceed

## 336 Of the Muscular Actions. Lect. xv.

proceed from the same Cause in different Degrees ; viz. from corpuscular Attraction.

Let us now endeavour to corroborate these Arguments by some suitable Observations.

1st, From what has been said, we may conceive more readily, than we know how to express, that the Will has a Power to direct the æthereal Medium contained in the Nerves, to any of the voluntary Muscles, with such a Degree of Celerity as it pleases ; and to stop the Influx as suddenly.

2dly, It is evident that the Tunics, or carnosus Substance of every Fibre, must necessarily increase in its Thickness, when it abates in its Length ; and what Power can produce this Effect, but such a one as increases the mutual Attraction between the constituent Particles ?

3dly, Hence appears the Reason, why the Middle of a Muscle swells during its Contraction, notwithstanding its Dimension in general is diminished ; for as the component Particles of each Fibre are more loosely connected about the Middle than towards its Extremities, which are generally tendinous, it is natural to suppose that the chief Action is between them ; that is, when a Fibre grows shorter, such of its Particles which are most at Liberty run nearer together, and as the Motion of all Bodies is ever in proportion to the Impulse they receive, and the Resistance they meet with, so when the constituent Particles of the muscular Fibres are drawn into a shorter Compass, by the means above-mentioned the Middle of the Fibres must swell either internally or externally, or both, according to the Resistances they meet with.

And lastly, Since the Tunics of the muscular Fibres do most certainly grow thicker as they contract in their Length, and yet the external Surface of the Muscle in general is diminished ; it manifestly follows that their Cavities must grow less,  
and



## Lect. xv. Of the Muscular Actions. 337

and their contained Fluids must be pressed out, in proportion to the Contraction of the Muscle.

This appears upon Blood-letting, when squeezing any thing hard in the Hand will make the Blood fly out with a greater Velocity, and thereby form a larger Parabola.

This also accounts clearly for the Induration and Paleness of a Muscle during its Action.

And again, it follows hence, that in the Action of the Muscles there is an alternate Diastole and Systole perfectly analogous to the Action of the Heart, which greatly contributes towards pushing on the Blood in the Veins.

The Muscles being contracted merely by the Influence of the nervous Æther, and the Influx of the Æther being stopt by withdrawing the Impetus given to it by the Power of the Will; the Reason and Manner of their Relaxation will easily appear. For since the nervous Fluid is extremely subtile, that Portion of it which is thrown into the muscular Fibres, acts but for a Moment, or the least Space of Time, so quick is it in its Motions, and so penetrating in its Nature; and no sooner is the Vigour of the Attraction over, but the Tension of the antagonist Muscles, and the Impulse of the Blood will extend them again.

Whoever duly considers the well known Effects of magnetical and electrical Effluvia will be at no loss to conceive the instantaneous Influence which the nervous Æther has upon the muscular Fibres.

It must be confessed indeed, that these Intima Naturæ, or secret Operations in the Animal Economy are all screened from our Knowledge, the Agents being too subtile ever to become the Objects of our Senses, though ever so well assisted; so that we can only form such collateral Proofs, or from such Data as we are pretty sure are true. As for Instance; the Influence which the Soul has

## 338 Of the Muscular Actions. Lect. xv.

upon the æthereal Medium in the Nerves must be by Impulse ; for though our finite Capacities are not able to comprehend the Nature of immaterial Impulse ; yet nothing is more certain than that the most subtil Matter in the Universe cannot be moved without some impressed Force.

That the Will does exert itself after this manner, is in a good measure proved by Dr. STUARTS'S \* Experiment upon a Frog, where a proper Impulse being given to the Medulla spinalis did excite Motion in the voluntary Muscles, though the Head was severed from the Body.

Hence also it appears, that the Nerves are always replete with a subtil Fluid capable of contracting the Muscles, or otherwise such as an Impulse on the Beginning of the Nerves, could not have excited Motion after the Head was cut off.

And again, common Experience assures us, that tho' the Nerves are always replete with an ætherial Medium, yet this Medium, in a State of Health, never flies out at their Extremities, into the muscular Fibres, without some Impulse by the Direction of the Will : Whenever it appears to do so, Convulsions and Cramps are the natural Consequences.

It may perhaps seem strange to some, that I have not all this while taken any Notice of the Blood, as an Agent in muscular Motion ; since it has ever been reckoned some way necessary towards it. But notwithstanding this Opinion has been so long and so generally received, yet if our Scheme be the true one, it evidently appears the Blood hath nothing to do with the immediate Contraction of the Muscles.

\* Lectures on Muscular Motion.

## Lect. xv. Of the Muscular Actions. 339

From the close Connection of the nervous Capillamenta in all or most of their Ramifications, to those of the Arteries, it seems as if the Diastole and Systole of the arterial System was some how useful to them. Perhaps it may assist in pushing on the Succus nutritus, or that clammy balsamic Juice which is in the Nerves, towards their Extremities; but I cannot conceive that the Blood itself is in any way assisting towards muscular Motion, except it be by keeping the Fibres warm, supple, distended, and every way ready for the Influx of the nervous Æther.

I have tied up and cut asunder both the carotid and both the crural Arteries of the same Dog, without destroying the Motion of one Muscle. Nothing less than laying a Ligature on the Aorta descendens will destroy the Motion of the hinder Parts; and possibly this may happen from the great Distension of the Aorta above the Ligature, pressing upon the Nerves which go to the lower Parts.

It is certain indeed, when all the Blood is intercepted the Fibres will soon collapse, and grow flaccid, and muscular Motion will cease, merely for want of the Warmth, Suppleness, and Distension which the Muscles receive from the Blood. But what I think most reasonable is, that the Blood is no Way concerned as an efficient Cause in pushing up and contracting the Fibres; it rather, by its Motion through the Muscles, acts as an Antagonist to their Contraction, by extending and distending them; for the Blood, by the Diastole and Systole of the Arteries, is continually urging on its Passage through the Muscles.

Thus I have endeavoured to deduce and illustrate the Cause of muscular Motion from true Principles, by pursuing only those Laws of Nature, which our great Philosopher Sir ISAAC NEWTON

## 340 Of the Muscular Actions. Lect. xv.

has in so surprising a manner discovered to us. But I am far from thinking this a complete Account; I know it requires more Experiments, and better Reasonings than I am Master of, to explain it as it ought; and even after all, there are, and ever will be, some Things above the Reach of our Capacities to demonstrate, any otherwise than by their Effects, or second Causes: Such are, the Nature of an immartial Impulse; the real Existence of so subtil a Fluid as is attributed to the Nerves; and the true Causes of Attraction and Repulsion.

The Existence or Non-Existence of the nervous Fluid, commonly called the animal Spirits, has been a Controversy of long standing. The first Searchers into the Structure of the human Body soon found that muscular Motion depended upon the Nerves, or something within them; and this has constantly been asserted, and admitted as a known Truth. The Advocates for the Existence of animal Spirits have generally supposed that voluntary Motion was performed by a sudden Inflation of the Muscles, either by the Power of the nervous Fluid itself, or by an instantaneous Ferment with some other Fluid; and I am apt to believe, that this Doctrine proving inconsistent with many Things relating to the Animal Oeconomy to some known Experiments, might give rise to the vibrating Scheme, where the Existence of the of the animal Spirits is denied, and where it is supposed that both Sensation and muscular Motion may be performed merely by the Elasticity of the Nerves, and Contractions first of all begun in the Brain, and so communicated to the fleshy Fibres: But this is so immechanical a Notion as not to deserve an Answer; it being impossible for a vibrating Motion in one Cord or String, were it ever so elastic, to cause a Contraction in another, without the Intervention of some Fluid.

## Lect. xv. Of the Musclar Actions. 341

I shall conclude this Lecture therefore with observing, that the Existence of an ætherial Medium in the Nerves is past all manner of Doubt; it being otherwise contrary to the known Laws of Nature for the Nerves to be the Cause of muscular Motion if they were solid, or did not admit the most subtil Fluid, secreted by the Glands of the Brain, to pass through them.

And since it is known from Experiment, that the Muscles grow less in Action, and, consequently, the constituent Particles of every Fibre must run nearer together before such a Phænomenon can happen; we think it very manifest that this Property of Constriction arises from the Principle of corpuscular Attraction being increased and strengthened by the Influence of the nervous Æther; a Principle, which, from the endless Divisibility and Subtilty of another, we know it to exist in Nature from innumerable Observations and Experiments.





## LECTURE XVI.

### Of the MUSCLES of the FACE, and the inferior MAXILLA.

**T**HE SUPERCILIA or Eye-brows, are the two hairy Arches, situated at the inferior Part of the Forehead; between the superior Part of the Nose and Temples, in the same Direction with the osseous Arches, which form the superior Margin of the Orbits. The Skin in which they are fixed does not seem to be much thicker than that of the rest of the Forehead; but the Membrana Adiposa is thicker than on the adjacent Parts.

The Extremity of the Eye-brows next the Nose is called the Head, as being larger than the other Extremity, which is named their Tail. Their Colour is different in different Persons, and often in the same Person, different from that of the Hair on the Head; neither is the Size of them always alike. The Hairs of which they consist, are strong and pretty stiff; and they lie obliquely, their Roots, being turned to the Nose, and their Points to the Temples.

The Supercilia have Motions common to them, with those of the Skin of the Forehead, and of the hairy Scalp. By these Motions the Eyebrows are lifted up, the Skin of the Forehead is wrinkled more or less regularly and transversely; and the  
Hair,

## Lect. xv. Muscles of the Face, &c. 343

Hair, and almost the whole Scalp, is moved ; but not in the same Degree in all Persons ; for some by this Motion alone can move their Hat, and even throw it off from their Head. The Eyebrows have likewise particular Motions which contract the Skin above the Nose ; and all these Different Motions are performed by the following Muscles.

The **FRONTAL MUSCLES** are two thin, broad, fleshy Laminæ, of unequal Length, lying immediately behind the Skin, and Membrana Adiposa anteriorly, which Parts they cover from the Root of the Nose, and through about two Thirds of the Arch of the Eyebrows on each Side, all the Way to the lateral Parts of the Hair on the Forehead. At the Root of the Nose they touch each other, as if they were but one Muscle ; and at this Place the Fibres are short and longitudinal, or vertical.

The next Fibres on each Side become gradually longer and more oblique, the most anterior being always the shortest and straightest ; and the lateral the longest, and turned most obliquely toward the Temples at their superior Extremities.

By this Disposition, an angular Interstice is formed between the Place where the two Muscles join, and the Hair on the Middle of the Forehead ; but this Disposition is not the same in all Subjects ; no more than the Wrinkles, and Bounds of the Hair on the Forehead.

These Muscles are fixed by the inferior Extremities of their fleshy Fibres, immediately in the Skin, running through the Membrana Adiposa. They cover the Musculi Superciliares, and adhere closely to them, by a kind of Inter texture. By the same Fibres they seem to be inserted in the angular Apophyses, of the Os Frontis, and to be blended a little with the Muscles of the Palpebræ

344      Muscles of the Face, Lect. xvi.  
and Nose. The superior Extremities of their fleshy Fibres are fixed in the external or convex Surface of the Pericranium. Each of their lateral Portions covers a Part of the temporal Muscle, on the same Side, and adheres very closely to it. The superior and inferior Insertions are graduated.

The OCCIPITAL MUSCLES, are two small, thin, broad, and very short fleshy Planes, situated on the lateral Parts of the Occiput, at some Distance from each other. They are inserted by the inferior Extremities of their fleshy Fibres in the superior transverse Line of the Os Occipitis, and also a little above it. From thence they ascend obliquely from behind forward, and are fixed in the interior or concave Surface of the Pericranium.

The Breadth of these Muscles reaches from the posterior middle Part of the Occiput, toward the mastoid Apophysis, and they diminish unequally in Length, as they approach these Apophyses. From this Inequality in Length, each of them appears, as if it were double in some Subjects; and in others they are so thin and pale, that they seem to be wanting. They are sometimes covered by an aponeurotic Expansion of the Trapezii.

The occipital and frontal Muscles appear to be true Digastrici, both in regard to their Insertions in the Pericranium, and in respect to their Action. Their Insertions in the Pericranium, are opposite, one being on the exterior Side, and the other on the interior Side; so that this Membrane or Aponeurosis, may be considered, as a middle Tendon of four single Muscles, that is, which have their fleshy Fibres fixed only to one Side of their Tendons. The fixed Insertions of the Occipitales, at the inferior Part of the Occiput, and the moveable Insertions of the Frontales, in the Skin of the Forehead and of the Supercilia, being well considered,



sidered, together with their reciprocal Insertions in the same Aponeurosis, seem to be a very convincing Proof that they are digastric Muscles.

These four Muscles seem always to act in Concert; the Occipitales being only Auxiliaries or Assistants to the Frontales, the Office of which is to raise the Supercilia, by wrinkling the Skin of the Forehead; these Wrinkles follow the Direction of the Eyebrows pretty regularly in some Subjects, and very irregularly in others.

To be convinced of the Co-operation of these four Muscles, we need only hold the Hand on the Occipitales, while we raise the Eyebrows, and wrinkle the Forehead several times; and we shall perceive the Occipitales to move each time, though not in the same Degree, in all Subjects. In some Persons the Occipitales seem to be relaxed, while the Frontales being in Contraction, move the whole Scalp and Pericranium forward, and then contract to bring them back to their natural Situation.

The MUSCULI SUPERCILIARES are fleshy Fasciculi situated behind the inferior Portion of the Musculi Frontales, from the Root of the Nose, to above one half of each superciliary Arch. They are strongly inserted, partly in the Synarthrosis of the Os Nasi, with the Os Frontis, where they come very near the proper Muscles of the Nose, and partly in a small circumjacent Portion of the Orbit. From thence they first ascend a little, and afterwards more or less in the Direction of the Eyebrows. They are formed of several small Fasciculi of oblique Fibres, all fixed by one End, in the Manner already said, and by the other partly in the inferior Extremity of the Muscles by which they are covered; and partly in the Skin of the Supercilia.

This last Portion is easily confounded with a Portion of the musculus Orbicularis Palpebrarum.

The

The Action of these Muscles is to depress the Eyebrows, to bring them close together, and to contract the Skin of the Forehead immediately above the Nose, into longitudinal and oblique Wrinkles; and the Skin which covers the Root of the Nose, into irregular transverse Wrinkles. This Action as well as that of the Frontales, and of the Muscles of the Nose and Lips, is not always arbitrary, but sometimes mechanical and involuntary. These Muscles may perhaps likewise serve to keep the muscoli Frontales, in Equilibrio during their Inaction, they being moveable by both Extremities.

THE MUSCLES OF THE PALPEBRÆ, are commonly reckoned two; one peculiar to the superior Eyelid, named Levator Palpebræ Superioris; the other common to both, called musculus Orbicularis Palpebrarum, which has been subdivided in different Manners as we shall see presently.

ORBICULARIS PALPEBRARUM. By the Musculus Palpebrarum Obliquus, we understand all that Extent of fleshy Fibres, which, by a thin Stratum, surrounds the Margin of each Orbit, and from thence, without any Interruption, covers the two Palpebræ all the way to the Cilia. The Fibres which ascend the Margin of the Orbit are nearly orbicular; but most of those which cover the Palpebræ, are transversely oval.

Most of them have a common Tendon situated transversely between the internal Angle of the Eye, and the nasal Apophysis of the Os Maxillare.

This is a slender ligamentary Tendon, strongest where it is fixed in the Bone, and diminishing gradually as it approaches the Angle of the Palpebræ where it terminates at the Union of the Points, or at the Extremities of the two Tarsi. The fleshy Fibres are fixed to it anteriorly, so that at

first Sight it appears to be no more than a *Linea Alba*.

From thence one Portion of the Fibres is turned superiorly, the other inferiorly; and both meet again at the external Angle, being united by a particular Kind of Intertexture, very difficult to be explained. When having inforced this Portion of the Muscle, we examine its posterior Surface, we observe a small thin tendinous Rope, which descends through the fleshy Fibres, and divides them all the way, from the Union of the two Tarsi, to the temporal Margins of the Orbit, where it disappears; the Fibres which lie beyond it, appearing to continue the main Circuit of the Muscle.

I divide this Muscle into four Portions, whereof the first is that which surrounds the Orbit, and which does not appear to be interrupted toward the Temples; the superior Part of it lying between the Supercilia, and the inferior Part of the *Musculi Frontales*.

The second Part is that which lies between the superior Margin of the Orbit, and the Globe of the Eye, and which covers the inferior Margin of the Orbit; some of its Fibres being fixed to both Margins of the Orbit.

RIOLAN divided this into two semi circular Portions one superior, the other inferior; the first lying between the *Musculus Superciliaris*, and the inferior Part of the *Musculus Frontalis*, to both which it adheres very much.

The third Portion seems to belong more particularly to the *Palpebræ*, and the greatest Part of it is spent in the *Palpebra superior*. The Fibres of this Portion meet at the two Angles of the Eye, where they appear to make very acute Inflexions without any Discontinuation; but when examined on the other Side next the Globe of the Eye, they

## 348 Muscles of the Face, Lect. xvi.

they have in some Subjects appeared to me to be distinguished into superior and inferior.

The greatest Part of these Fibres form a transversely oval Circumference, the shortest Diameter of which is longer when the Eyes are open than when shut.

The fourth Portion is an Appendix to the Third, from which it differs chiefly in this, that its Fibres do not reach to the Angles, and form only small Arches, the Extremities of which terminate in each Palpebra. This Portion is really divided into two, one for the Margin of the superior Eyelid, the other for that of the inferior. RIOLAN names this Portion, *Musculus Ciliaris*.

All these different Portions of the orbicular Muscle adhere to the Skin, which covers it, from the superior Part of the Nose to the Temples; and from the Supercilium, to the superior Part of the Cheek: When they contract, several Wrinkles are formed in the Skin, which vary, according to the different Direction of the Fibres; those under the inferior Palpebra are very numerous, and descend very obliquely from the anterior to the posterior.

The Skin of the superior Palpebra is folded Archways, almost in a parallel Direction to that of the semi-oval Fibres, the Plicæ intersecting the Levator; whereas the other Folds only intersect the Orbicularis. The radiated and oblique Plicæ seldom appear in young Subjects, except when the first and second Portions of the Orbicularis are in Action; but in aged Persons, the Marks thereof are visible at all times.

In Man the superior Palpebra has much more Motion than the inferior. The simple Motions called Twinkling, which frequently happen, though not equally often in all Subjects, are performed in the superior Palpebra, by the alternate Contraction  
of

of the Levator and superior palpebral Portion of the musculus Orbicularis; and in the inferior Palpebra, at the same time or alternately, by the inferior palpebral Portion of the Orbicularis; but as there is but a small Number of Fibres in this Portion, these Motions are but very inconsiderable in this Eyelid.

These slight Motions, especially those of the superior Palpebra, are not very easy to be explained according to the true Structure of that Part; the Motions which wrinkle the Palpebræ, and which are commonly performed, to keep one Eye very close shut, while we look stedfastly with the other, are explicable, by the simple Contraction of all the Portions of the Orbicularis. These Motions likewise depress the Supercilia, which consequently may be moved in three different Manners, superiorly by the Musculi Frontales, inferiorly, by the Orbiculares, and anteriorly by the Superciliares.

The LEVATOR PALPEBRÆ SUPERIORIS is a very thin Muscle, situated in the Orbit, above and along the Rectus superior Oculi. It is fixed to the Bottom of the Orbit, by a small narrow Tendon, near the Foramen Opticum, between the posterior Insertions of the Rectus Superior, and Obliquus Superior. From thence its fleshy Fibres descend forward on the Rectus; increasing gradually in Breadth, and terminate by a very broad Aponeurosis, in the Tarsus of the superior Palpebra.

There is so much Variety to be met with in the Muscles of the Lips in different Subjects, that it is no Wonder to find them so variously described by Anatomists, very unlike one from another. In some Subjects, Portions of these Muscles are wanting; in some they can scarcely be distinguished, because of the Paleness and Attenuation of the Fibres;  
and

## 350 Muscles of the Face, Lect. xvi.

and in others there are really some particular Fasciculi, which are not generally to be found.

The Muscles of the Lips are commonly divided into common and proper; the common are those which end at the Angles or Commissures of the two Lips; and those are proper, which are fixed in one Lip only, which are again subdivided into the proper Muscles of the superior Lip, and proper Muscles of the inferior Lip. All these Muscles have particular Names, some of which are taken from something in the Confirmation of the Muscles, some from the Insertions or Situation, and some from the Uses attributed to them.

The Muscles to which I confine myself may be enumerated in the following Order, viz.

The SEMI ORBICULARES are commonly looked upon as one Muscle, surrounding both Lips, from whence it is called Orbiculares; but when we examine carefully the Angles of the Lips, we find that the Fibres of the superior Lip intersect those of the inferior Lip, and we easily distinguish the muscular Arch of one Lip from that of the other; and for this Reason I divide this Muscle into two, and I call them either by the common Name of Semi-Orbicularis, or one of them Semi-Orbicularis superior, and the other Semi-Orbicularis inferior; but the Name of Semi-Ovales would be still more proper.

The superior semi-orbicular Muscle is oftentimes broader than the inferior; and it has this peculiarity likewise, that all its Fibres do not go to the Corner of the Mouth, but terminate by Degrees, between the Middle and Extremities of this Arch, nearly like the semi-oval Fibres of the superior Palpebra.

The inferior semi-orbicular Muscle is commonly more uniform in the Disposition of its Fibres.

The

The SUPRA SEMI-ORBICULARES are Fibres which increase the Breadth of the two lateral Portions of the superior Semi-Orbicularis upward, and they appear at first Sight to be one continued Arch, like the Muscle last named, but being narrowly examined, they will be found to be separated by a small Interstice, lying betwixt their contiguous Extremities, which are fixed in the Gums, opposite to the Margin of that cutaneous Fossula, that descends from the Septum Narium, to the middle of the Margin of the superior Lip. Their other Extremities are confounded with those of Semi-Orbicularis superior, their Uses are to draw the Lips close together.

The BUCCINATORES are two in Number, each of them are situated transversely between the posterior Part of the two Maxillæ, and the Corner of the Mouth; they are broader posteriorly, and narrower anteriorly, in the Shape of a Triangle or Trapezium, and they form a considerable Portion of the Cheeks, and for that Reason are sometimes called the Muscles of the Cheeks. To have a just Idea of these Muscles, we must be made acquainted with a Ligament, on each Side of the Face, which I call Ligamentum Inter-maxillare, because it connects the two Maxillæ, and also gives Insertion to the posterior Fibres of the Buccinator.

This Ligament is strong and pretty broad. It is fixed by one End to the exterior Side of the superior Maxilla, above the last Dens Molaris, and at the Side of the Apophysis Pterygoïdæus, Internus: By the other End it is fixed in the posterior superior Extremity of the oblique prominent Line, on the exterior Side of the inferior Maxilla, below the last Dens Molaris. It serves likewise as a Frænum to check and limit the Depression

## 352 Muscles of the Face, Lect. xvi.

pression of the inferior Maxilla, in opening the Mouth, especially when it is wide open.

The BUCCINATOR is inserted posteriorly in three different Places. The middle Fibres are fixed transversely in the Ligamentum Inter-maxillare, and descend directly to the Corner of the Mouth. The superior Fibres descend in an oblique graduated Manner, from the Alveoli of the superior Maxilla to the Corner of the Mouth; and the inferior Fibres ascend from the inferior Maxilla in the same Manner.

All these Fibres contract by Degrees, as they approach the Commissure of the Lips, where they run in behind the Extremities and Union of the Semi-Orbiculares, by which they are covered, and to which they adhere closely.

There is a large Hollow between this Muscle, and the Masseter filled with Fat; its Use is not only to move the Cheeks with the Eyes, but also to contract the Cavity of the Mouth, by bringing them internally, and so thrust the Meat between the Teeth for its better Communication.

The ZYGOMATICI MAJORES are two Muscles situated one on each Side between the Zygoma, and the Corner of the Mouth. Each Muscle is thin, long, oblique, and fixed by one Extremity to the inferior Margin of that Portion of the Os Malæ, which is connected with the Zygomatic Apophysis, of the Os Temporis; from thence it descends obliquely from behind forward, being in its Passage, commonly involved in Fat. It ends at the Commissure of the two Lips, adhering strongly to the Buccinator which covers it. This Muscle is very often complex; its Use is to draw the Lips superiorly.



## MUSCULI PROPRII LABII SUPERIORIS.

The ZYGOMATICI MINORES are two small slender Muscles, lying above the great Zygomatici, and almost parallel to them. Their superior Extremities, seem to be a Detachment from the inferior Fibres of the Orbicularis Palpebrarum; but they may be always distinguished. Their inferior Extremity unites with the neighbouring Incisorius. These Muscles are quite buried in Fat, and for that Reason often disappear; their Uses are the same as the former.

Elevator of the superior LIPO CANINI is fixed by a broad Insertion, in the superior Maxilla, above the Socket of the Dens Caninus, in a Depression below the inferior Margin of the Orbit, near the Os Malæ. From thence it descends a little obliquely, crossing the inferior Extremity of the Zygomaticus Major, which covers it at this Place. Afterwards it terminates at the Extremity of the Arch of the Semi-Orbicularis superior, and communicates by some Fibres, with the Triangularis. I formerly looked upon this as a neutral Muscle, that is being neither a proper Muscle of the Lip, nor common to both. Its Uses is to draw the superior Lip externally, and when both act, to put it down.

INCISORII LATERALES: Each of these two are a sort of Biceps; its superior Part being divided into two Portions, which unite below. One of those superior is larger than the other, and is fixed in the Os Maxillare below the middle Tendon of the Orbicularis Palpebrarum seeming to communicate by some Fibres, with the contiguous Fibres of that Muscle; thence it descends a little obliquely toward the Cheek, along the Apophysis

Physis Nasalis, mixing with the Pyramidalis Nasi, and sending some Fibres to the Nares; afterwards it passes over and adheres to the Myrtiformis, or Transversalis Nasi, and unites with the other Portion.

This other Portion is fixed by a broad Insertion, immediately below the Margin of the Orbit, in the Os Maxillare, near the Union of this Bone with the Os Malæ, and likewise a little in the last named Bone, being at this Place covered by the inferior Portion of the Orbicularis Palpebrarum, with which it has sometimes a kind of Communication: From thence runs down obliquely toward the Nose, and unites with the first Portion.

The two Portions thus united and contracting in Breadth, run behind the Semi-Orbicularis superior, and are fixed therein opposite to the lateral Dens Incisorius. Sometimes it sends, a small Fasciculus of Fibres to the Musculus Caninus, which may be reckoned an Assistant to that Muscle, and named Caninus Minor.

The INCISORII MEDII or Elevators of the Lips are commonly called Incisorii Minores Cowperi, or Incisorii Minores Superiores. They are two small short Muscles, situated near each other below the Septum Narium. They are fixed by one Extremity in the Os Maxillare, on the Alveoli of the first Incisores, behind the Semi-Orbicularis Superior; and by their other Extremity, in the middle and superior Part of the Substance, of the superior Lip, near the Nares, in which they likewise have an Insertion; and they sometimes send lateral Fibres, to the Semi-Orbicularis. When it acts it draws that Lip externally, and when both in concert, pull it superiorly.

## MUSCULI PROPRII LABII INFERIORIS.

Each of those two *Triangulares*\* or *Depressors* of the inferior Lips is fixed externally by a broad Extremity; the Basis of the inferior Maxilla from the *Masseter* to the Foramen near the Chin. From thence it ascends, contracting in Breadth, in a bent triangular Form, runs in between the Extremities of the *Buccinator*, and *Zygomaticus Major*, to both which it adheres very closely, and terminates at the Commisſure of the Lip, partly in the *Semi-Orbicularis superior*, and partly though not always equally in the *Semi-Orbicularis inferior*. This Muscle seems sometimes to be a Continuation of the *Caninus Major*.

The *Quadratus* or *Elevator Menti* of the Chin forms the thick Part of the Chin, below the under Lip. It is a very complete Muscle, and very difficult to be prepared, because its Fibres are interwoven with a great Quantity of Fat, or a pellicular Texture, of the *Membrana Adiposa*. It is first of all inserted anteriorly to the inferior Maxilla, where it partly fills, the broad Fossula on each Side of the Symphysis. From thence it ascends intersecting, along the Symphysis, the contiguous Fibres of the Skin, and terminates by a broad Insertion, in the *Semi-Orbicularis Inferior*. The Direction of the other Fibres, of which it is composed, varies in different Subjects, and it communicates by some Fibres, with the *Cutanei*.

The *INCISORII INFERIORES* or *Elevators* of the inferior Lips are two small Muscles, commonly mentioned with the Addition of *COWPER*'s Name.

\* Professor *WINSLOW* notes this amongst the proper Muscles of the inferior Lips, but with Submission to his Authority, I think they are common to both Lips.

## 356 Muscles of the Face, Lect. xvi.

Each of them is fixed by the superior Extremity, on the Alveoli of the lateral Incisores, of the inferior Maxilla. From thence, they descend approaching each other, and are inserted together in the inferior Part of the middle of the Semi Orbicularis Inferior.

On the external Insertion of the superior of each of these Muscles, we meet with a Fasciculus of Fibres, which seem to be detached from it near the Incisores. This Fasciculus goes off laterally in Form of an Arch, and unites with the Fibres of the Semi-Orbicularis Inferior, with which it may be easily confounded. It may be looked upon as a Musculus Accessorius, to the Semi-Orbicularis Inferior, or as a Collateralis to the Incisorius Minor.

### THE MUSCLES OF THE INFERIOR MAXILLA ARE FIVE PAIR.

The MASSETER is a very thick fleshy Muscle, situated on the lateral Part of the Cheek. It seems to be composed of three Portions, like a Triceps, viz. one large and external, one middle, and one small and internal.

The external Portion is fixed by one tendinous Extremity to all the inferior Margins of the Os Malæ, and a little to the adjacent Parts of the Os Maxillare and Apophysis Zygomatic of the Os Temporum. Thence it descends obliquely backward, (being entirely fleshy,) and is inserted by the other Extremity in the rough Impression on the external Side of the Angle of the inferior Maxilla.

The middle Portion is fixed by one End to the inferior Margin of the whole Apophysis Zygomatic of the Os Temporum and a very little to that of the Os Mallæ. Thence it descends a little obliquely forward in an opposite Direction to the  
first

first Portion, under which it crosses, and is inserted by its other Extremity in the Middle of the Inside of the Ramus of the inferior Maxilla, near the Insertion of the external Portion with which it mixes.

The third Portion which is least and most internal, is fixed by one Extremity to the internal Labium of the inferior Margin, and also to the Inside of almost all the Zygomatic Arch; and by the other, to the Basis of the Coronoid Apophysis, where it mixes wholly fleshy with the Insertion of the middle Portion. This third Portion by its Nearness of Situation, seems sometimes to be an Appendix of the Temporal Muscle.

The TEMPORAL Muscle, is broad and flat resembling the Quadrant of a Circle in Figure, it occupies all the semi-circular or semi-oval Plane of the lateral Region of the Cranium. The Temporal Fossa and Part of the Zygomatic Fossa. From this Situation it has its Name and likewise that of Crotaphites which is sometimes given to it.

To conceive justly the Insertions of this Muscle: It must be observed that through all the Circumference of the semi-circular Plane already mentioned. The Pericranium is divided into two Laminæ. The internal Lamina, sometimes taken for a particular Periosteum, covers immediately all the osseous Parts of this Region. The external Lamina separated from the other, is spread out like an aponeurotic or ligamentary Tent, by means of its Adhesions to the Os Frontis, to the posterior Margin of the superior Apophysis of the Os Mala, to the superior Margin of all the Zygomatic Arch, and to the Root of the Mastoid Apophysis.

This Muscle is composed of two Laminæ of fleshy Fibres, fixed to the two Sides of a tendinous

## 358 Muscles of the Face, Lect. xvi.

Lamina nearly of the same Breadth with them by which they are separated, it being spread quite through the Muscle like a concealed middle Tendon, as may be plainly seen by dividing the Muscle all the way to the Bone, according to the Direction of its Fibres. The Body of this Muscle thus formed is inclosed between the two aponeurotic or ligamentary Laminæ in the following manner.

The internal fleshy Lamina is fixed by a broad radiated Insertion to all the semi-circular Lamina of the Cranium, by the Intervention of the internal Lamina of the Periosteum.

Thus it is fixed to the lateral external Part of the Os Frontis, and to its external angular Apophysis, to the inferior Part of the Os Parietale, to the squamous Portion of the Os Temporis, to the great Ala or temporal Apophysis of the sphenoid Bone, by which the temporal Fossa is formed; and a little to the posterior Side of the internal orbital Apophysis of the Os Malæ which forms Part of the Zygomatic Fossa.

Through all this Space the fleshy Fibres contract gradually, by means of their adhesions to the tendinous Laminæ, which diminishes in Breadth, and increases in Thickness, and in Proportion, as it descends. The external fleshy Lamina is fixed in the same radiated Manner to the Inside of the external Lamina of the Pericranium from the great semi-circular Circumference all the way to a small Portion of this Lamina more or less semi-circular, above its Insertion in the Zygomatic Arch. Here the fleshy Fibres leave the external Lamina, and the void Space thus formed between the small semi-circular Portion, and the fleshy Fibres is commonly filled with Fat.

Through the whole Extent of this Insertion the fleshy Fibres gradually contract, and adhere to the Outside of the middle tendinous Laminæ in the  
same

same manner as the internal Lamina adheres to the other Side but in a contrary Direction.

The middle tendinous Lamina continuing to contract by Degrees, ends at length in a very considerable Tendon; the Extremity whereof, which is in a manner double, incloses the coronoid Apophysis of the inferior Maxilla, being strongly inserted in the Margins and Inside thereof, and also a little in that Part of the Bone which lies between the two Apophyses. The internal Portion of this Insertion is thicker and has more fleshy Fibres than the external, which is almost entirely tendinous or aponeurotic.

There is another small Lamina reckoned by some to be a Portion of this Muscle, which in reality is no more than the third Portion of the Masseter, as may be easily perceived by sawing of the Zygomatic Arch at the two Ends, and then turning it down; for this small Muscle parts from the Temporalis without Difficulty, and continues to adhere to the Masseter.

#### PTERYGOÏDÆUS MAJOR OR INTERNUS.

This Muscle lies on the Inside of the inferior Maxilla, almost in the same Manner as the Masseter does on the external Side, being of the same Figure with that Muscle, only smaller and narrower.

It is fixed above in the Pterygoïd Cavity, chiefly to the Inside of the external Ala of the Apophysis Pterygoïd. This Insertion is fleshy; and from thence the Muscle has its Name: It descends obliquely toward the Angle of the inferior Maxilla, and is inserted a little tendinous in the Inequalities on the Inside thereof, opposite to the Insertion of the Masseter; it might be called also Masseter Internus.

## PTERYGOÏDÆUS MINOR OR EXTERNUS.

This is an oblong fleshy Muscle, much smaller than the other, and situated almost horizontally between the external Side of the Apophysis Pterygoïd, and the Condylöid Apophysis of the inferior Maxilla; the Subject being considered in an erect Posture.

It is fixed by one Extremity on the external Side and Margin of the external Ala of the Pterygoïd Apophysis, filling the Fossula, which is at the Basis of this Apophysis, near the Basis of the Apophysis of the Sphenöid Bone.

From thence it descends posteriorly and a little externally, into the void Space between the Apophysis of the inferior Maxilla, and is inserted anteriorly in the condylöid Apophysis at a small Fossula immediately under the inner Angle of the Condyle, it is also fixed to the capsular Ligament of the Articulation.

DIGASTRICUS is a small long Muscle situated laterally between the whole Basis of the Maxilla and the Throat. It is fleshy at both Extremities and tendinous in the Middle, as if it consisted of two small Muscles joined endways by a Tendon, and from thence it is called Digastricus in Greek, and Biventer in Latin.

It is fixed by one fleshy Extremity in the Sulcus of the Mastöid Apophysis; from thence it descends anteriorly inclining towards the Os Hyöides, where the first fleshy Body ends in a round Tendon; which is connected to the lateral Part and Root of the Cornua of that Bone by a kind of aponeurotic Ligament, and not by a Vagina or Pulley as appears at first Sight, because of its Passage by the Extremity of the Musculus Styloglossus.

Here



Here the Tendon is incurvated and presently ends in the other fleshy Body which is immediately above the internal Labium of the Basis of the Chin near the Symphysis, in a small unequal Depression. This Insertion is broader than that of the other Extremity; sometimes the anterior Insertions of the two Digastrici touch each other, and sometimes several of their Fibres cross each other considerably.

PLATISMA MYOIDES are two Cutaneous Muscles which form a kind of fleshy Membrane, which covers the whole Foreside of the Throat and Neck, from the Cheek and Chin, all the way down below the Claviculæ, and adheres very strongly to the membranous or aponeurotic Expansion before described. This Expansion has a particular Adhesion to the anterior Portion of the Basis of the inferior Maxilla, of the same Kind with that at the inferior Part of the Zygoma, and it is spread over all the Muscles that lie round the Neck, and over the superior Portion of the Pectorales Majores, Deltoïdes, and Trapezi.

The Fibres of each cutaneous Muscle descend obliquely upward and forward, and meet and seem to intersect those of the other Muscle, at acute Angles, from the Sternum, all the way to the Chin.

They adhere strangely to the inferior Portion of the Masseter, Triangularis, and Buccinator, their fleshy Fibres become aponeurotic, but continue longer on the Triangularis, being mixed with the Fibres of that Muscle all the way to the Commissure of the Lips. They likewise advance a little, on the circumjacent Portion of the Quadratus.

The Portion of these Muscles, which answers to the Basis of the Triangularis, is in a manner divided into two fleshy Laminæ, the outermost of which

which is what advances over the Triangularis, and Quadratus, the other being inserted separately in the inferior Maxilla.

I have sometimes observed a Part of the fleshy Extremity of the right Side, to pass before the Symphysis of the Chin, over a little Part from the left Side, the one covering the other.

The common Muscles of the Lips either draw both Corners of the Mouth at once, or only one at a time, according to the different Direction of their Fibres.

The proper Muscles pull the different Parts of the Lips, in which they are inserted. The Buccinators, in particular, may serve to move the Food in Mastication. An entire Treatise might be written on the almost innumerable Combinations of the different Postures, in which a Man may put his Face, as I shall shew elsewhere.

None are more affecting, than those produced by the Cutanei alone, especially in Weeping, which they do by their Adhesions to the Triangulares, &c. But their Insertions in the Bone of the inferior Maxilla, they draw up the inferior Part of the Integuments of the Neck, and those of the Breast next to these, for they cannot move the Maxilla.

In old People, and in those who are very much emaciated, these Muscles may be perceived by the Eye, under the Skin, and on the Neck.

#### MUSCLES OF THE NOSE\*.

SIX MUSCLES are commonly reckoned for the Dilation of the Nose. Two Recti, called also

---

\* Dr. DUGLAS in his Myography, allows but one Pair to the Nose.

Pyramidales or Triangulares ; two Obliqui or Laterales, and two Transversi or Myrtiformes.

In very muscular Bodies, there are likewise some supernumerary Muscles, or small Accessorii. The Nose may also be moved in some Measure by the Muscles of the Lips, which in many Cases become Assistants, to the proper Muscles of this Organ.

The MUSCULUS PYRAMIDALIS, or anterior on each Side, is inserted by one Extremity in the Synarthrosis of the Os Frontis, and Ossa Nasæ, where its fleshy Fibres mix with those of the Musculi Frontales, and Superciliares. It is very flat, and runs down the Side of the Nose, increasing gradually in Breadth, and terminating by an Aponeurosis, which represents the Basis of a Pyramid, and is inserted in the moveable Cartilage which forms the Ala of the Nares.

The OBLIQUE DESCENDENS or LATERAL MUSCLE, is a thin, fleshy Plane, lying on the Side of the former, and in some Subjects, appearing to form one broad Muscle, with it. This is possibly the Reason why the anterior Muscle has been termed Triangularis. The lateral Muscle is fixed by its superior Extremity to the Apophysis Nasalis of the Os Maxillare, below its Articulation with the Os Frontis, and sometimes a little lower than the Middle of the inner Margin of the Orbit. From thence it descends toward the Ala Narium, and is inserted in the moveable Cartilage, near the Os Maxillare, being covered laterally by a Portion of the circumjacent Muscle of the superior Muscle of the superior Lip, with which, in some Subjects, it appears to be confounded.

OBLIQUES ACENDENS, or Transverse Inferior, are called also Myrtiformis, is inserted by one End in the Os Maxillare, near the inferior Margin of the Orbit, much about the Place which answers to the Extremity of the Socket of the Dens Caninus,

## 364 Muscles of the Face, Lect. xvi.

on the same Side. From thence it descends almost transversely upward, and is fixed in the lateral Cartilages of the Nose, over which in some Subjects, it seems to run to the Alæ of the great Cartilage and to be inserted there.

The first two Pair of these Muscles, raise and dilate the Alæ of the Nares, when they act; and at the same time, raise the superior Lip, by means of their Connection, with the Muscle of that Part. They likewise wrinkle the Skin on the Sides of the Nose.

As for the Contraction of the Nostrils, it seems to depend on the Action of some fleshy Fibres detached from the Orbicular Muscle of the Lips, which terminate in the Margin of the Nostrils and Cartilage which divides them, wherefore the Action is only sensible in depressing the superior, in order to make it meet with the inferior Lip. But this Kind of Clusion of the Nostrils is never shut so exact as to secure the Nose, from the Ingress of any extrenous Impressions, whatever Pain we take in contracting this Muscle.

### USES OF THE MUSCLES WHICH MOVE THE INFERIOR MAXILLA.

The two TEMPORALES acting together, raise the inferior Maxilla, press the Teeth against the superior Teeth, and pull it back when it has been carried so far forward, as that the inferior Incisores get before the superior. They perform the least Motion by their most posterior Portion which passes over the Root of the Zygomatic Apophysis, and the other Motions by the Co-operations of all their muscular Radii.

The two MASSETERS serve to raise the inferior Maxilla to push the inferior Teeth against the Superior, in which they co-operate with the Temporales.

rales. They likewise bring this Maxilla anterior, by their external and largest Portion; and move it laterally by their superior Portions acting alternately. By the Co-operation of all the three Portions, they press the lower Teeth against the upper.

Both Pterygoïdæi Interni serve to raise the lower Maxilla to bring the inferior Teeth near the superior, and to move the Maxilla laterally, as in grinding the Food. They cannot bring the Maxilla anteriorly in Order to set the inferior Incisores before the Superior, in which Action they are Antagonists to the posterior Portion of the Temporales and the great Portion of the Masseters. When one of them acts, it carries the Chin obliquely forward, or twines it towards the other Side. This oblique Motion is performed alternately by these two Muscles acting singly.

The two DIGASTRICI\* serve to depress the inferior Maxilla and to open the Mouth, in doing which, the Mechanism of these Muscles has appeared to all Anatomists to be very singular, on Account of their middle Tendons, their Insertions, Adhesions, and their manner of pressing by another Muscle. The Incurvation of this middle Tendons, has not only been looked upon as necessary to change the Direction of the Muscles, but it has been believed that without this Change of Direction, they could not have depressed the Jaw any farther, than the Weight of the Maxilla would contribute to that Action.

This Incurvation and Passage has been compared to that of a Rope over a Pulley, without which Advantage it was thought that these Muscles

---

\* Professor MONRO does not admit digastric Muscles to depress Maxilla, but their Uses are for the Deglutition. See Medical Essays Vol. 1. Article 9.

could not resist the continual Efforts of the powerful Antagonists, nor overcome any exterior Opposition, such as the Hand pressing upon the Chin. But when we examine carefully the Structure of the Maxilla and the Insertions of these Muscles, it appears evidently that their Connexion with the Os Hyoides is not necessary for the Use assigned to them of depressing the Jaw; as may be proved both in a Skeleton and on a fresh Subject.

In a Skeleton in which the Motion of the inferior Maxilla preserved by Art, we need only tie a piece of Packthread to the lower Part of the Chin where the Digastricus is inserted, and then keeping the inferior Maxilla close to the superior, by any proper Contrivance, pass the other End of the String through the Mastoid Scissure, and we shall perceive by pulling the String in a strait Direction between these two Places, that the Maxilla will be depressed.

This Experiment may be made without the Help of a Spring, or any other Contrivance to keep the Maxilla shut, by simply inverting a proper Cranium, so that the inferior Maxilla, may by its own Weight fall on the superior; for by drawing the String as before, the inferior Maxilla will be raised, that is, parted from the other, and by letting the String go, it will fall back again to its first Situation.

On a fresh Subject the Experiment may be made in the following Manner. The Connexion of the Digastricus with the Os Hyoides and Muscles, Stylo Hyoidæus begin intirely destroyed; let it be pulled by its posterior Extremity directly toward the mastoid Scissure, in the same Manner as the String was drawn, in the foregoing Experiments.

Anatomists have not considered that the two Rami of the inferior Maxilla are crooked or angular Levers, and that each Degastricus passing by the

the Angle in that Bone, ought to be looked upon as being inferted therein, ſo that the Action of the Lever is to be confined to that Portion which lies between the Angle and the Condyle, without taking in what lies between the Angle of the Chin.

It may be asked therefore why the anterior Inſertion of the Degaſtricus reaches ſo far as the Chin, ſince it might have been in the Angle of the Bone? and what is the Uſe of its Connexion, with Os Hyoides, of its Incurvation and Change of Direction? The firſt Queſtion is answered by calling to Mind what has been ſaid about the Extent or Largeneſs of Motion, about the Neceſſity of long Fibres for large Degrees of Motion, and about lateral Motion. Had this Muſcle been inferted in in the Angle, its Fibres would not have been proportioned to the Degree of Motion required, and for the ſame Reaſon, the lateral Motions would have been obſtructed.

In Answer to the ſecond Queſtion about the Connexion of this Muſcle with the Os Hyoides and its Incurvation, it is to be remembered that the Degaſtricus has another Uſe, beſides that of depressing the inferior Maxilla; which is to aſſiſt in Deglutition, of which it is one of the principal Organs. WINSLOW has demonſtrated this Uſe of the Digaſtricus above eight Years ago, in his public Courſes in the College of Phyſic and at the Royal Garden, but as the whole Mechanifm of Deglutition cannot be explained, till the Tongue, Larynx, and Pharynx, have been deſcribed; I ſhall only add in this Place the following Remarks, to prove the Uſe of the Digaſtrici in that Action.

We cannot ſwallow without raiſing the Larynx or Pomum Adimi, as it is commonly called, at the ſame time, as every one may ſatisfy himſelf laying his Hand on that Part of the Throat in the Time of Deglutition. We are likewiſe obliged to  
keep

keep the inferior Maxilla raised while we swallow, and when it is depressed we find that Action impossible. Lastly, the Larynx cannot be raised but by Means of its Connexion with the Os Hyoides; and the Muscles of that Bone are too weak to resist the Efforts of the Basis of the Tongue, and of the solid Food which we swallow.

Therefore while the temporal and masseter Muscles keep the inferior Maxilla closely applied to the superior in Deglution, the Digastrici contract at the same Time, as may be felt by putting the end of the Finger upon the Place where they are inserted in the Edge of the Chin. And as the inferior Maxilla remains immoveable, the Digastrici are heightened by their Contraction, and by the Connexion of their middle Tendons with the Os Hyoides, they raise that Bone and the Larynx together with it. The Force of these Muscles is very considerable, as may be shewn by laying the Elbow on a Table, and leaning with the Chin on the Hand, while we endeavour at the same time to depress the inferior Maxilla; for as in that Case this Jaw cannot descend, the Digastrici by their Insertions, in the Apophysis Mastoïdæ, raise the superior Maxilla. A Piece of Wood supporting the Chin in Place of the Arm, will render this Experiment more sensible and more certain. The involuntary Motion termed Yawning, is likewise a Proof of the Strength of these Muscles.

In the Action of the Digastrici in Deglution, we meet with one very singular Phænomenon, of which there is hardly another Example to be found among all the Muscles of the human Body. For in all other Instances, wherever antagonist Muscles act at the same Time, they all co-operate in producing what is called a Tonic Motion but in this Case the Levators and Depressors of the inferior Maxilla act together for different Uses; that  
is



is, the temporal and pterygoid Muscles are in Action to raise the Jaw and keep it in that Situation, while the Digastrici, their Antagonists, perform an Office which has no Relation to that Bone.

Two Eminences in one Bone articulated with two Cavities in another, allow only of two contrary Motions as in a Ginglymus, and in the Articulation of the Occipitis with the first Vertebra. But the inferior Maxilla, though articulated by the Condyles with the glenoid Cavities of the Os Temporum, has four direct Motions, one anteriorly, one posteriorly, one inferiorly, and one superiorly; and two lateral Motions, one to the right, the other to the left. And lastly, in all Degrees of direct Motions, it may at the same time have any Degree of lateral Motion.

This Contrivance depends on the inter-articular Cartilages described among the fresh Bones. In the inferior Side of each of these Cartilages, there is but one Cavity suited to the Convexity of the Condyle, which it receives; and is not turned directly inferiorly, but obliquely posteriorly; as the Condyle is not turned superiorly, but obliquely anteriorly. The superior Side is concave anteriorly, and convex posteriorly, answering to the articular Eminence and Fossula of the Os Temporis.

In the natural Situation of the inferior Maxilla, and while it remains in Inaction, it is so disposed as that the anterior Convexity of the Condyles answers obliquely to the posterior articular Eminences of the Os Temporum, and with this Disposition, that of the inter-articular Cartilages agree.

In the direct Motions upward, the Cartilages slide posteriorly and superiorly toward the Meatus Auditoricus, the Condyles still continuing in the Cavity of their lower Sides, as is most evidently

# 370 Muscles of the Face, &c. Lect. xvi.

perceived when we press the Teeth hard against each other ; and the same thing happens in the direct Motions forward. In the direct Motions downward, the Cartilages slide downward and forward ; the Condyles still remaining in their inferior Cavities, and the same happens in the direct Motions.

In the lateral Motions, the Condyles are carried alternately to the right and left Sides, and the Cartilages follow their Motions ; so that the Condyle on that Side toward which the Maxilla is turned externally, and that on the opposite Side sinks inward ; the prominent Condyle having at the same time a small Motion backward, and the other Condyle forward.

From these Observations we learn that the ginglymoïd Motions of the inferior depend particularly on the inferior Cavities of the inter-articular Cartilages ; and that the Motions forward, backward, and to either Side depend on the superior Side of these Cartilages. The Pterygoïdæi Interni move the Maxilla anteriorly, the posterior Portions of the Temporales move it posteriorly ; the left Pterygoïdæus Internus turns it to the right, and the Pterygoïdæus Internus to the left. The Pterygoïdæus Externus of one Side, and the posterior Portion of the Temporalis of the other Side, may at the same time perform the small Motions before mentioned.



## LECTURE XVII.

## MYOGRAPHY.

## OF THE ABDOMINAL MUSCLES.

**B**Y the Muscles of the Abdomen, we mean those which form principally the Sides or Circumference of that Cavity. They are commonly ten in Number, five on each Side; eight whereof are very large, the other two very small.

Of these Muscles, two are long, called *Musculi Recti*; two small, called *Pyramidales*; six broad, two of which are named *Obliqui Externi*; two *Obliqui Interni*, and two *Transversales*. The *Pyramidales* are wanting in some Subjects: Sometimes there is but one, and sometimes three. The Name of these two Muscles has been taken from their Figure, those of the other eight from the principal Direction of their Fibres.

These ten Muscles lie in Pairs, and those of each Side appear to be separated by a kind of tendinous Line or Band running along the anterior Part of the Abdomen, from the Cartilago *Ensiformis* to the Symphysis of the *Ossa Pubis*, and including the *Umbilicus*; above which it is pretty broad, but narrow below, especially near the *Ossa Pubis*.

This tendinous Band is named *Linea Alba*, which

is only formed by the Intexture of the Tendons of six broad Muscles.

I shall here describe only the five Muscles of one Side; the other five being exactly like these; and the same Method will be observed through the whole of this Treatise, as we did that of the Bones.

*OBLIQUUS EXTERNUS*, or *Ascendens* is a broad thin Muscle, fleshy superiorly and posteriorly, tendinous on the anterior and greatest Portion of the inferior Part. It reaches from half the lateral and inferior Part of the Thorax, to almost half the lateral and superior Part of the Pelvis; and from the posterior of the *Regio Lumbaris* to the *Linea Alba*.

It is fixed superiorly to the Ribs, inferiorly to the *Os Ilium*, *Ligamentum Fallopii*, and *Os Pubis*, and anteriorly to the *Linea Alba*. The posterior Portion next the *Lumbar Vertebrae* has commonly no true muscular Insertions.

In the first Place it is fixed to eight Ribs (seldom to nine) that is, from the fifth true Rib to the last of the false, by the same Number of Angles of its fleshy Portion in the following Manner. It adheres to the external Labia of the inferior Margins of the two or three last true Ribs, and of the four following false Ribs, at their osseous Extremities; to the Extremity of the Cartilage of the last false Rib to the external Labium of the inferior Margin of that Rib, and a little to the broad Ligament which connects it to the transverse Apophyses of the first Vertebra of the Loins.

The Insertions in the osseous Extremities of the Ribs are at different Distances from the Cartilages in the sixth, at a little more Distance; in the fifth the Distance is about an Inch; in the first false Rib two Inches; in the second and third, three Inches; in the fourth, about two Inches, and sometimes

sometimes less ; in the fifth, the Insertion reaches, and in a manner surrounds, the Cartilage.

The Name of the Digitations or Indentations has been given to these angular Insertions, because they join like a Number of the same Kind belonging to other Muscles, as the Fingers of the two Hands are locked between each other. Three or four of these Digitations belong to the Serratus Major ; and the same Number to the Latissimus Dorsi. The three or four lowest Digitations join likewise those of the Serratus Posterior inferior, which are covered by the Extremities of the Latissimus Dorsi.

Though these Digitations appear entirely fleshy, yet they are almost a little tendinous posteriorly. They seem to increase in Breadth as they descend, and often unite more or less with the intercostal Muscles in their Passage over them. Sometimes they communicate likewise with the pectoral Muscle, the Serratus Major, and Latissimus Dorsi, by distinct Fasciculi of fleshy Fibres, which are true reciprocal Continuations of these Muscles.

There are likewise other internal Insertions covered and hid by those which appear externally, and which belong to the Ribs lying immediately below those to which the external Digitations are fixed. Thus the Digitation fixed in the last true Rib sends off a Fasciculus to the first false one as it ascends anteriorly thereof.

The first Digitation, or that belonging to the fifth true Rib, appears longer than the rest, and is about the Breadth of two Fingers, having communicating Fibres with the Pectoralis Major. The second, or that of the sixth true Rib, is about an Inch in Breadth, and unites a little with one Digitation of the Serratus Major. The third, or that of the seventh true Rib, is about three Fingers in Breadth, and runs for a small Space toward the

## 374 Abdominal Muscles. Lect. xvii.

Cartilage externally to the Rib. The fourth, or that of the first false Rib, mixes by some of its anterior Fibres with those of the Serratus Major. The fifth, or that of the second false Rib, mixes both with the foregoing and the first Digitation of the Latissimus Dorsi, and runs for some Space on the Surface of the Rib. The sixth, or that of the third false Rib is about two Fingers in Breadth, and sends off a Fasciculus of Fibres to the Serratus Major. The seventh is of the same Breadth with the former, and some of its Fibres are continued to the Serratus Posterius inferior. The eighth, or that belonging to the lowest false Rib, has been already described.

From these Insertions of the Ribs, the Fibres of this Muscle run down obliquely from behind forward. Those which come from the three lowest Ribs are less oblique than the rest, appearing to form a distinct Portion, which continues fleshy all the way to the external Labium of the Crista Ossis Illium, in which it is inserted from the posterior Part of this Portion seems to me to consist of a double Lamina.

The other Portion of this Muscle, though not altogether separated from the former, runs more obliquely; and after some Space, its fleshy Fibres degenerate into a strong broad Aponeurosis, or thin Tendon; the Extremities of the fleshy Fibres from the fifth true Rib to the anterior Spine of the Os Illium, forming a Line, which, till it reaches as low as the Umbilicus, is strait, and thence inferiorly, is incurvated posteriorly. One Portion of the tendinous Lamina descends to the anterior and superior Spine of the Os Illium, whence it unites a little with the superior Tendon of the Musculus Satorius, and afterwards is continued to the Spine of the Os Pubis, being by its inferior Margin firmly

ly united to the Ligamentum Fallopii, and adhering closely to the Fascia Lata.

This Aponeurosis grows firmer and thicker in its Progress toward the Os Pubis, and in old Age becomes hard and dry; for which Reason, Hernias are most troublesome in old People, and more difficult to be cured. A little before it reaches the Os Pubis, it is divided into two Portions, one superior or anterior, the other inferior or posterior, between which a Fissure or Opening is left of a particular Kind.

The superior or anterior Portion obliquely descends toward the Spine or the Os Pubis, crosses over the Foreside of the Symphysis, and is inserted in the inferior broad Part of the Os Pubis on the other Side. As it passes the Symphysis, it crosses the like Portion of the other external Oblique, and their Fibres decussate each other.

The inferior or posterior Portion descending more inferiorly in the middle Part of the Symphysis, some small Portion of it being continued to the Os Pubis on the other Side.

Near their Extremities these two Portions approach, so that the Opening formed by them is in some measure oval, but narrower below than above. Through this Opening the spermatic Vessels pass in Men, and the round Ligaments in Females; but in them the Opening is much inferior than in Males. It is about two Fingers Breadth in Length, and about half a Finger in Breadth at its superior Part, and is there strengthened by several tendinous Fibres detached obliquely from each Side, which form a sort of roundish Border, from whence these Openings got the name of Annular or Rings. These collateral Fibres hardly appear in Children.

The inferior or posterior Portion sends off a particular Expansion to the Fascia Lata, which hav-

## 376 Abdominal Muscles. Lect. xvii.

ing formed a Covering for the Inguinal Glands, is afterwards lost in the Fat.

The remaining Part of the Tendon of the external Oblique is fixed by oblique Fibres in the Linea Alba through its whole Length, mixing with those that come from the same Muscle on the other Side.

These tendinous Fibres are likewise continued a great way beyond the Linea Alba through the Tendon of the other Muscle, and this Intertexture is reciprocal. Those who look upon the fleshy Part of this Muscle as its Beginning, call it *Obliquus Descendens*, and it has likewise been named *Obliquus Superior* and *Obliquus Major*.

*OBLIQUUS INTERNUS*, or *Descendens*, is a broad thin Muscle like the former, having nearly the same Extent and Insertions, that is, in the inferior Ribs above; in the Crista of the *Os Ilium*, and *Ligamentum Fallopii*, below; and in the Linea Alba, before; but it differs from it in this, that its inferior Part is more fleshy than the superior.

One Portion of its inferior Extremity, which is entirely fleshy, is fixed by very short tendinous Fibres in the middle Space between the two Labia of the Crista *Ossa Ilium*, from the Posterior of the Tuberosity of that Crista near the Symphysis of the *Os Sacrum*, almost all the way to the superior and anterior Spine of the *Os Ilium*; so that its Insertion reaches further back than that of the external Oblique.

The fleshy Fibres thus fixed, ascend first a little obliquely from behind forward, and then this Obliquity increases proportionably as the Fibres lie more anteriorly, and they cross those of the fleshy Portion of the external Oblique, being afterwards inserted exteriorly in the inferior Margins of the Cartilages of all the false Ribs, and those of the

two



## Lect. xvii. Abdominal Muscles. 377

two lowest true Ribs, reaching to the Extremity of the Cartilago Ensisformis.

These Insertions form fleshy Digitations at the Extremity of the lowest false Rib, at the ossæous Extremity of the fourth, and through all its Cartilage, and at the middle Portion of the Cartilage of the third. Here the Insertions become tendinous, and an Aponeurosis is formed, which, from the second false Rib anteriorly, is divided into two Laminæ by which the Musculus Rectus is inclosed.

The other Portion of the inferior Extremity of this Muscle, continuous with the former, is fixed to the anterior Extremity of the Crista of the Os Illium, to its anterior and superior Spine, and to that Part of the Ligamentum Fallopii which lies nearest it. From all this Insertion, the Fibres expand like Raddii through the whole Extent of the Linea Alba. Those from the Crista descend superiorly toward the Linea Alba, and afterwards they gradually change their Direction, till at length they become almost perpendicular to that Line. Those that come from the Spine and Ligamentum Fallopii, are gradually bent downward, and are inserted partly in the Spine, partly in the Symphyse of the Os Pubis, being inseparably mixed with the inferior Margin of the Aponeurosis of the external Oblique.

This anterior or radiated Portion being at its Beginning wholly fleshy, becomes afterwards entirely tendinous, and together with the Tendon of the other Portion, forms an Aponeurosis like that of the external Oblique, the Extremities of all the fleshy Fibres forming an oblique Line a little bent from above downward, beginning at the third false Rib, and reaching to the Ligamentum Fallopii.

The Aponeurosis of the internal Oblique thus formed, is afterwards divided into two Laminæ,  
from

## 378 Abdominal Muscles. Lect. xvii.

from the Extremity of the second false Rib, to its inferior Margin; and having by this Division furnished a Vagina to the Musculus Rectus and Pyramidalis of the same Side, the two Laminæ unite again at the Linea Alba, being interwoven with those belonging to the Muscle on the other Side, and mixed with the Aponeurosis of the External Oblique in a very singular Manner. This Aponeurosis is every where closely connected to that of the external Oblique, and the Vagina of the Rectus seems to be stronger above the Umbilicus than below it, and nearer the inferior Extremity of the Linea Alba becomes so thin, that the Rectus and Pyramidalis may be seen through it.

In the Passage between the anterior and superior Spine of the Os Ilium, and Os Pubis, at some Distance above and behind the tendinous Opening or Ring of the external Oblique; the fleshy Fibres at the inferior Margin of the internal Oblique, leave a Passage for the Spermatic Vessels in Men, and for the Vascular Ligament commonly called the round Ligaments in Females. This Passage is near the Place where this Muscle connects the Aponeurosis of the former; and though it appears in some Subjects to be formed by a real Separation of the fleshy Fibres, in others it lies between the fleshy Margin of this Muscle and the Insertion of the Obliquus Externus in the Ligamentum Fallopii. In this Course a Fasciculus of fleshy Fibres is likewise detached from this Muscle, which contributes to the Formation of a small Muscle called Cremaster.

There is moreover a thin Plane or Series of fleshy Fibres between the posterior Part of this Muscle, and the Aponeurosis of the Musculus Transversalis, which covers the Quadratus Lumborum, and seems to be fixed by a broad Aponeurosis to the Ligament which goes between the last  
Lumbar

## Lect. xvii. Abdominal Muscles. 379

Lumbar Vertebra and to the Tubercle of the Crista Ossis Ilium. From thence it ascends obliquely forward, and contracting in Breadth, is fixed in the Extremity of the last false Rib. Therefore if this Series be reckoned a Part of the internal Oblique, this Muscle must be said to be inserted not only in the Crista of the Os Ilium, but also in the last Lumbar Vertebra, by means of the Ligament already mentioned.

This Muscle is likewise called *Obliquus Descendens*, for the same Reason that the former is termed *Ascendens*; *Obliquus Inferior* and *Obliquus Minor*, because it does not reach so high, and is not quite so large as the external Oblique.

**MUSCULI RECTI.** They are narrow Muscles, thicker than the *Obliqui*, and lie near each other like two large Bands, from the lower Part of the Thorax to the Os Pubis, the *Linea Alba* coming between them. Their Breadth diminishes, and their Thickness increases gradually from above and downward.

The superior Extremity of each Muscle is fixed to a Part of the inferior Extremity of the Sternum to the three lowest true Ribs, and to the first false Rib, by the same Number of Digitations, of which that which is furthest from the Sternum is the broadest.

The Substance of the Muscle lies in the Vagina, formed by the Aponeurosis of the broad Muscles of the Abdomen. Exteriorly it is divided into several Portions resembling distinct Muscles placed endways, by transverse Tendons termed *Enervations*, which commonly are all above the Umbilicus, very seldom below it, and they adhere very close to the Vagina.

These Insertions are pretty irregular. They do not always penetrate the whole Thickness of the Muscle; and in that Case they do not at all appear,

pear, or but very little, on the interior Surface. Sometimes those which are seen on the exterior Surface do not run quite cross the whole Breadth of the Muscle.

The inferior Extremity of this Muscle is narrower than the superior, and ends in a thin Tendon fixed in the internal Labium of the superior Margin of the Os Pubis near the Symphysis, and there it touches the Tendon of the other Rectus.

Above the Umbilicus, these two Muscles are at some Distance from each other, according to the Breadth of the Linea Alba; but below it they come nearer, the Linea Alba being there narrower, and near their inferior Extremity that Line is almost entirely hid by their thick Margins.

MUSCULI PYRAMIDALES. At the inferior Part of the Recti we meet commonly with two small Muscles, which at first seem to be a Portion or Appendix of the former. They are named Pyramidales from their Figure, and by FALLOPIUS Succenturiati.

At the inferior Extremity they are broad and thick, being there fixed to the superior Margin of the Offa Pubis, immediately before the Recti. They decrease gradually in Breadth and Thickness as they ascend, and end by a Point in the Linea Alba, a little Distance below the Umbilicus.

They are partly inclosed within the Vagina of the Recti, running close by each other along the Linea Alba, to which they are fixed at different Distances by oblique tendinous Indentations, the superior Extremities of which are sometimes very long.

Sometimes these Muscles are wanting, and then the inferior Extremities of the Recti are thicker than usual. Sometimes there is only one Pyramidalis; and sometimes they are not both of the  
some

## Lect xvii. Abdominal Muscles. 381

some Size and Length. We very rarely meet with three in one Subject\*.

TRANSVERSALES. They are nearly of the same Breadth with the Obliques. Their Name is taken also from the Direction of their Fibres, and each of them is fixed to the Ribs, above; below, to the Os Ilium and Ligamentum Fallopii; before, to the Linea Alba; and behind, to the Vertebrae.

The superior Part of this Muscle is fixed to the inferior Part of the interior Surface of the Cartilages of the two lowest true Ribs, by fleshy Digitations, the Fibres of which run more or less transversely toward the Linea Alba, at some distance from which they become tendinous. These Digitations meet, and exactly correspond with those of the Diaphragm, but never mix with them in the human Body.

The middle Part is fixed to the three first lumbar Vertebrae by a double Aponeurosis or two tendinous Planes, one internal or anterior, the other external or posterior. The internal is inserted in the transverse Apophyses, the external in the spinal Apophyses and interspinal Ligaments, being closely united to the tendinous Expansions of the circumjacent Muscles; and the external Laminæ of both Transversales appear to be continuous, their common Insertion in the spinal Apophyses by no means hindering them from sliding like a Girth, towards either Side on the Processes just mentioned.

The internal and external Planes having inclosed in their Duplication, the musculus Sacro-Lumbaris and Quadratus Lumborum unite in one strong Aponeurosis at the Margins of these Muscles. From this Aponeurosis arises the middle and great-

---

\* I have met with these Muscles in old Women, one of which reached almost to the Navel.

est Part of the fleshy Portion of the Transversalis, which, together with the superior Part, advances toward the Linea Alba, and at some Distance from it, becomes tendinous.

The inferior Part of this Muscle is fixed by an Insertion entirely fleshy to the internal Labium of the Crista Ossis Ilium, and to a great part of the Ligamentum Fallopii. From thence many of Fibres run towards the Linea Alba, the rest to the Os Pubis, all of them becoming more or less tendinous before their Insertion.

It is commonly said that there is a Separation in the fleshy Fibres of this Portion behind that supposed to be in the internal Oblique, for the Passage of the spermatic Vessels, &c. There is indeed a Sort of Aperture, but it is so very near the internal Oblique, as to make it very doubtful at first Sight, whether it be formed by a Separation of the Fibres of the Transversalis, or lies between the fleshy Margins of that Muscle, and of the obliquus Internus, which, after a careful Examination, appears to be the Case.

This Proximity makes it no easy Matter for many Anatomists to determine whether the fleshy Fibres, of which the Cremaster Muscle partly consists, belong entirely to the internal Oblique, or whether some of them do not likewise come from the Transversalis, as others do from the Ligamentum Fallopii.

The middle Part of the fleshy Plane of this Muscle ends in a very broad Aponeurosis closely adhering to that of the Obliquus Internus, the Vagina or Duplicature of which it strengthens interiorly, as that of the external Oblique does exteriorly. Afterwards this Aponeurosis reaches the Linea Alba, and joins that of the other Transversalis by a particular Sort of Intertexture, without mixing either with the internal Oblique, or with  
the

## Lect. xvii. Abdominal Muscles. 383

the Peritonæum. The whole Aponeurosis of the three Parts of this Muscle, from the fleshy Fibres to the Linea Alba, represents a Kind of Crescent, and it was for this Reason that the Ancients have said that it terminated anteriorly in a semilunar Line.

The common Uses are to sustain the Viscera of the Abdomen, and to counterbalance the perpetual Motions of ordinary Respiration, and thereby gently and continually to act on the Viscera; which Action may be reckoned a Sort of Trituration, of great Importance to the Animal Oeconomy. They compress the Abdomen in order to clear it of what ought to pass off by the natural Outlets, to relieve the Stomach by Vomiting, from whatever might be hurtful to it; and lastly to drive out by a violent Expiration whatever may incommode the Organs contained in the Thorax.

These two kinds of Motion are carefully to be distinguished. The first is purely mechanical, and in a manner passive; the other is arbitrary and really active.

In the first, the Viscera, pressed by the Diaphragm in Inspiration, force these external Muscles on all Sides, overcoming their natural Elasticity; but the Diaphragm being relaxed in Expiration, and yielding to the Viscera, they recover themselves again. In the second, these Muscles really act, that is their fleshy Fibres are contracted and shortened, and thereby they compress the Viscera, especially the Stomach and Intestines, forcing out by the nearest Passages whatever is capable of Expulsion.

In this latter Case the Diaphragm acts while the Abdominal Muscles are in Contraction, and thereby concurs in an universal Compression of the Belly; but in the first Case it does not act, as shall be fully shewn hereafter.

but

The particular Disposition of the fleshy tendinous Portions of the Obliqui and Transversales, renders this Compression uniform, and thereby the Muscles resist the Force of the compressed Viscera, almost equally on all Sides.

The Musculi Recti serve to support the Trunk of the Body when inclined posteriorly, and to bend or bring it anteriorly again; to raise the Body up when lying; and lastly, to climb. They serve, I say, to bend the Trunk when inclined backward or laid down; for when we stand strait, they have no Hand in bending the Body forward, except we be striving to overcome some Resistance. The Weight of the Thorax, Head, and superior Extremities, joined to the determinate Relaxation of the posterior Muscles of the Back and Loins, produce this Effect in all other Cases, as has been already mentioned in the general Observations on the Action of the Muscles.

WINSLOW is not as yet convinced that the Recti can contribute any thing to the arbitrary Compression of the Abdomen, which has been already mentioned as one common Use of all these Muscles.

The Pyramidales seem only to assist the Action of the Recti; though when we consider the oblique Direction of their Fibres toward the Linea Alba, there may be some Reason to think that they compress the Bladder, especially when very full of Urine, as FALLOPIUS has remarked. The lower Portions of the internal Obliques and Transversales may perhaps contribute something to this Effect; for when contracted, they form a flat tight Kind of Girth, by the Middle of which the superior Extremities of the Pyramidales are kept immoveable, while their Bodies being shortened and flattened by contracting, press upon the Bladder.

The oblique Muscles are capable of acting by distinct Portions. Their posterior Portions have  
The



nearly the same Uses on each Side as the Recti have before ; that is, they serve to support the Trunk on one Side when it is inclined to the other ; to bend the Body to that Side on which they lie, and to raise one Side of the Pelvis or Hip, while the other is well supported.

The superior and anterior Portions of the external Oblique of one Side, serve to turn the Thorax upon the Pelvis as upon a Pivot, the Pelvis remaining fixed and immoveable by sitting. This Motion may be termed the Rotation of the Thorax on the Pelvis.

When we stand and turn the Thorax to each Side in the same manner, this Motion is not at first the Rotation already mentioned ; for the Feet remaining then fixed, the Legs and Thighs turn to one Side and carry the Pelvis along with them ; but this Motion being carried as far is possible, and the Pelvis being consequently in a Manner fixed, the Rotation of the Thorax then takes Place, by Means of the two opposite oblique Muscles in the Manner already said.

When all the Portions of these four Muscles act together, they may assist the Recti in great Efforts ; as for Instance, when with the Arm or Thorax we push forward a very heavy Body, or drag it after us.

The Transversales seem to have no other Use than that of bracing or girding the Abdomen in different Portions thereof, and these again may gradually succeed each other. For Instance, the superior Portion may contract separately, while the inferior Portion is totally relaxed, as I have often observed in myself.

There are still other Uses belonging to these Muscles, but they cannot be intelligibly explained till several others have been described.

OBSERVATION on the CONNEXION of the  
OBLIQUI and TRANSVERSALES.

These three Muscles are not only united by their inferior Margins, and inserted together in the Ligamentum Fallopii, but also braced by the Adhesion of the Fascia Lata to that Ligament, and by the Connection of its ligamentary Fibres with the Tendon of the external Oblique. This Place is commonly called the tendinous Arch of the Muscles of the Abdomen, because it appears in this Shape when the Fascia Lata is removed. This Connexion is strengthened by a very thin Expansion of tendinous Filaments which decussate the Aponeurosis of the Obliquus Externus, and reaching all the Way to the Fissure, strengthen the superior Margin thereof in the Manner already said.

When this tendinous Expansion is separated from the Aponeurosis of the External Oblique, in young Subjects and in Women the Apertures do not any more appear like a Ring, but simply as a void Space left by the Separation of the tendinous Fibres. This Expansion seems to be formed by a Continuation partly of the tendinous Fibres of the Obliquus Externus, and partly of those of the Fascia Lata.

The two oblique Muscles and the Transversalis of each Side, are disposed in a very singular Manner, with relation to their fleshy and tendinous Portions; for the Tendons of some of them answer to the fleshy Parts of the rest. The external Oblique is most tendinous in the inferior Part and most fleshy in the Superior. The internal Oblique is most tendinous in the superior Part, and most fleshy in the inferior. The Transversalis is most tendinous in the Middle and most fleshy in the superior

perior and inferior Parts. By this Disposition these three Muscles compose nearly an uniform Plane, the fleshy and tendinous Fibres being equally distributed through all its Parts.

It is commonly said that the Linea Alba is only the Concourse or Place where these three Pairs of Muscles meet ; but if we examine well, we find there an Intermixture not easy to be unravelled. One Portion of the external Oblique of one Side seems to be continued with a Portion of the internal Oblique of the opposite Side, these four Portions making only two digastric Muscles, which cross each other obliquely. In the same Manner, the two Transversales by the Union of their Aponeurosis, form a third digastric Muscle ; so that we have here three broad Fasciæ or Spanfions very artfully crossing one another, formed indeed not by the whole Muscles, but only by the middle Portions of them.

The Linea Alba is perforated by a small round Foramen near the Middle of its Length ; the Circumference of which is formed by tendinous Fibres, twisted and interwoven in such a Manner, as to produce a regular and perfectly round Border. Before Birth, this Hole transmits the Funis Umbilicalis, and then it is pretty large ; but in Adults it is very much contracted.





## LECTURE XVIII.

### Of the NATURE of the BLOOD of the HUMAN BODY.



THE very complex Liquor, which is contained in the beating Arteries and their corresponding Veins, is called by one general Name, the Blood, which, to a loose Examination, appears homogeneous, or of similar Parts, red and coagulating throughout. But Experiments of divers Kinds have shewn us, that dissimilar Parts of various Natures reside in the Composition of this animal Liquor.

Hydrostatical Experiments demonstrate in the Blood, first a Kind of volatile Vapour or Exhalation, which immediately and continually flies off from the warm Juices with a Sort of foetid Odour coming betwixt that of the Sweat and Urine; this Vapour, being caught and condensed in proper Vessels, appears of a watery Nature, joined with a small Tincture of an alkaline Disposition.

This Halitus of the Blood consists of an ammoniacal Salt, so attenuated as to be volatile, without altering its Nature much to the alkaline Class, which, joined with a small Portion of Oil and much Water, affords that remarkable nedorous Smell upon opening a Dog, Hog, or other carnivorous Animal whilst warm, for in Oxen, Sheep, Calves, &c.

&c. feeding on Grass, or Grain, it hath scarce any perceptible Smell; but in Mankind, it has a very particular Odour, flying off chiefly in the Perspiration, by the Scent of which every Dog can distinguish and follow the Foot Steps of his Master.

After this Vapour is gone off, the Blood of a healthy Person spontaneously congeals into a solid trembling Mass, and with a less Degree of Heat than that of boiling Water, (viz. 150. gr. i. e. 62. less than boiling Water) it grows more tough like to a boiled Egg. But even within the Vessels of a living Person, dying of a Fever, the Blood has been seen by the Violence of that Distemper, changed into a concreted tremulous Jelly throughout all the Veins. The principal Part of this coagulated Mass, is the Crassamentum or Cruor, which has the red Colour peculiar to itself, and gives it to the other Part of the Blood. This, if it be not kept fluid by the Attrition of a vital Circulation, or some similar Concussion, runs confusedly into a compact, but soft Mass, merely by Rest and a moderate Degree of Cold, as it also does by the Addition of Alcohol, by mineral Acids, or by a Heat of 150 Degrees, (of which 98 is the Blood's Heat in robust People; 175 boil Alcohol Vini; 190 boil proof Brandy; and 212 boil Spring Water.) 'Tis either as a Fluid or Solid specifically heavy, and more so than Water, by near an eleventh Part; and when freed from its Water, it is wholly inflammable. In a Mass of healthy Blood, one Half or upwards of its red Cruor; and in strong laborious People the Serum makes only a third Part, and is still more diminished in Fevers, often to a fourth or fifth Part of the Mass.

Next to this comes the white or clear, and the yellowish Part of the Blood, which again seems to

be a Liquor, consisting of homogeneous or similar Parts, when it is not so. This Serum (as it is called) of the Blood, is in general, one thirty-eighth Part heavier than Water, and almost a twelfth Part lighter than the red Mass of Crassamentum; this too, by a Heat of an hundred and fifty gr. or by Mixture of mineral Acids or Alcohol, and by a concussive Motion is congealable into a much harder Coagulum than the red Cruor, or mixed Mass; and forms an undissolvable Glue, a Flesh like Membrane, which at length shrinks up to a Horn-like Substance. From thence are formed the pleuritic Crusts or Skins, Polypusses and artificial Membranes. In this Serum of the Blood besides the Albumen, which will harden like the White of an Egg, there is concealed a great deal of simple Water, which even makes the greater Part of the whole, and some Quantity of ropy Mucus drawing out into long Filaments like Spiders Threads; which last, however, is not coagulable like the Albumen, neither by Fire nor by Acids.

But by Putrefaction only, or the dissolving Power of the Air, hot to 96. gr. equal to the Blood's natural Heat, the whole Mass, but especially the Serum dissolves or melts into a foetid Liquor, first, the Serum, and then the Cruor more slowly; till, at length, the whole Mass both of Serum and Cruor, are turned into a volatile and foetid Exhalation, leaving very few Fæces behind. When the Blood has been once dissolved by Putrefaction there is no Artifice can harden or congeal it; as there is none likewise that can resolve it again, after it has been once coagulated by Spirits of Wine. The natural gelatinous Density and Cohesion of the Blood is dissolved in malignant and contagious Fevers.

Besides.

Besides these Parts of which the Blood appears to consist, without subjecting it to any Violence, it contains in its Substance a Quantity of Sea Salt, which is discernable to the Taste, and sometimes visible by the Microscope. The fine chalky Earth lodged in the Blood, is demonstrated from its affording the Matter of Nutrition and from a chymical Analysis, whereby it appears to lodge in the most fluid Parts of it, and is more especially intimately combined in great Plenty in the oily Parts of the Blood. Another Part in the Blood is Air, in an unelastic State, and that in a very considerable Quantity, (to the Weight of half a Scruple in an Ounce) the Existence of which Air, in the Blood and Serum, is proved by their Putrefaction and Distillation, or by removing the ambient Air from them by the Pump. But we are not to think hence, that the Blood Globules are Bubbles full of Air, for they are specifically heavier than the Serum, and make no Dilatation, by taking off the Pressure of the Atmosphere from them by the Pump. (Lastly it appears from late Experiments, that the Caput Mortuum, or Ashes of the Blood are replete, with a Sort of Iron, which the Load Stone will attract; and which being found also in the Ashes of Vegetables, as well as Animals, and in most earthy Bodies, is therefore by some, reckoned an Element or constituent Principle of Bodies.)

Among other Bodies, Chymistry has various Ways endeavoured to show us the Nature and Principles of the Blood; which being fresh drawn, and distilled with a slow Heat, (gr. 212, or below boiling Water) yields a Water to the Quantity of five Parts in six of the whole Mass, which Water has little or no Taste or Smell, till you come towards the End of the Operation, when it is pro-

portionably more charged with a foetid Oil, as it draws nearer to a Conclusion. What remains after you have drawn off this Water, being exposed to a stronger Fire, yields various alkaline Liquors, of which the first being acrid, foetid, and of a redish Colour, is usually called the Spirit of Blood, consisting of a volatile Salt, with some little Oil, dissolved in Water, to the Amount of one fifteenth Part of the whole original Mass of Blood. A little before and together with the Oil, that next ascends in the Distillation, a dry volatile Salt arises and adheres in the branchy Fleeces to the Neck and Sides of the Glasses; and this in but a small Proportion, less than an eighteenth Part of the first Mass. The next Liquor is that called Oil of human Blood, which ascends gradually thicker and heavier, at first yellow, and afterwards darker to a black, till at last it resembles Pitch; being very acrid and inflammable, but in a small Quantity, about a fifteenth of the whole Mass. What remains of the Blood, in the Bottom of the Retort, is a very spongy inflammable Coal or Cinder, which, being kindled, burns away and leaves Ashes behind; which being dissolved into Lixivium with Water, affords a mixed Salt, partly Sea and partly fixed Alkali, leaving a mere dead Earth in the Filter. This fixed Salt is scarce the five hundredth Part of the first Mass, and has in itself only one fourth Part alkaline: But being urged with the most intense Degree of Fire, the whole Salt affords some Portion of an acid Spirit; which we judge to arise partly from the Marine Salt in the Blood, some of which is demonstrable even in the Spirit of Blood, and partly from the vegetable Kind of the Aliments, not yet digested into an animal Nature. For which last Reason, an Acid is procurable from the Blood of herbivorous Animals, as well as from  
that



that of Man. But the Earth separated from the Lixivium by Filtration, will, perhaps, make about the one hundred and fiftieth Part of the original Mass, and contains some Particles which are attracted by the Load Stone. The Serum only of the Blood, by Distillation, also affords altogether the same Principles, only the Water is more abundant, as the Oil and Earth are in a less Proportion.

From the preceding Analysis of the Blood, it evidently contains a Variety of Particles, differing in Bulk, Weight, Figure, and Tenacity, some watery, others inflammable, and most of them inclined greatly to Putrefaction, or to an alkaline corroding State. For the Blood in a sound healthy State, not injured by Putrefaction, or too violent a Degree of Heat, is neither alkaline nor acid, but mild or gelatinous, and a little saltish to the Taste, yet in some Diseases it is sharp enough, and comes to a State of Putrefaction; as for Instance, in the Scurvy, where it corrodes through its containing Vessels, and in those who have an Ascites or Dropsy, whose Waters are often much of a corroding and alkaline Nature; but that which is as Blood in Insects affords a sharp alkaline Calx, effervescing with Acids. If human Blood be mixed with Alcohol or strong mineral Acids, it runs into a Coagulum; but by the milder vegetable Acids, Verjuice, Vinegar, Lime Juice, &c. and also by alkaline Salts, fixed or volatile, but especially the last, and by Nitre or all neutral Salts, it continues or even re-assumes its first Fluidity. There is no Salt with which the Blood makes any Effervescence; violent Exercise, too long continued with too great external Heat, soon dissolve the Blood into a putrid State, even within the Vessels of a living Person.

Lastly, by viewing fresh Blood in a small Glass Tube, by a Microscope, or by inspecting it by the  
same

same optical Instrument while it is yet moving in the Veins of the living Animal, we distinguish its soft red Globules, which are elastic, so as to be able to change and recover their Figure, and which doubtless, make the Part called Cruor or Crassamentum of the Blood. (If it be questioned, whether these are not rather oleaginous lenticular Particles of the same Kind as those observed by LEWENHOECK in Fish, and lately discovered in our own Species; we confess it is a Point difficult to determine; but the ready and frequent Division of Oil or Fat into Globules by Concussion seems to countenance such an Opinion.)

Those red Globules we see swimming in a thinner Liquor, in which, by the same Microscope, we also distinguish lesser yellow Globules; and observe that the red ones dissolve into similar yellow, or smaller Globules by Rest and Warmth. The Diameter of the red Globules is, by the most accurate Experimentors in this Way, computed at  $\frac{1}{3240}$  an Inch.

The pellucid Water remaining, in which the former Globules were observed to swim, does yet, by the finer Microscopes, appear to contain still smaller Globules, of an aqueous Clearness, with various Spicula of Salts.

From the preceding Experiments compared together arises that Knowledge which we at present have of the Blood; namely, that the Crassamentum or Cruor is composed of Globules, which, being forced together by the coagulating Causes, which increase their Attraction of Cohesion, harden into a confused solid Mass. The inflammable or combustible Nature of the said Globules is proved from dried Blood, which takes Flame and burns, as also from the Phosphorus, or rather Pyrophorus, (since it not only shines but generates com-

combustible Fire) which is distilled from human Blood; and from these probably arises the greatest Part of the pitchy Oil that is obtained from Blood by the Violence of Fire. But actual Filaments, there are none naturally in the Blood; though they be made in it by the Addition of cold Water.

The yellow Serum of the Blood appears likewise to consist of lesser Globules swimming in Water; and in what we described before, in the watery or thinner Liquor of the Serum, whose Particles are not visible to the Eye; there are contained the same Principles with a Portion of Water, as was shewn in the Blood itself, of which the Force of Fire makes alkaline Salts. In proof of this, we may alledge a Distillation of the Saliva or Mucus with the Nature of the perspiring Matter of Sanctorius.

The exact Mass or Quantity of Blood, contained in the whole Body, cannot be certainly computed, yet we know in general that the Mass of Humours is much greater than that of the Solids; only we are to consider, that many of them do not flow currently in the Circulation, as the Glue or Jelly that lodges in most Parts, and the Fat. But if we may be allowed to form a Judgment from these profuse Hæmorrhages that have been sustained without destroying the Life of the Patient, with Experiments made on living Animals, by drawing out all their Blood, joined with the Bulk of the Arteries and Veins themselves; from these Principles, the Mass of circulating Humours will be at least fifty Pounds, whereof near a fifth Part will be true red Blood current in the Arteries and Veins, of which the Arteries contain only one fifth, and the Veins the other four.

Nor does the Blood always contain the same, or a like Proportion of those Elements or Principles, which we have before described in it: For an increased

creased Celerity, whether by laborious and strong Exercises and a full Age, (from 30 to 40) Fever or otherwise, augments the Crassamentum with the Redness and congealing Force and Cohesion of Particles; and the Hardness and Weight of the concreted Serum, with the alkaline Principles are, by the same Means, increased; on the other Hand, the Serum and the Mucus it contains are increased by the contrary Causes the more as the Animal is younger, less active, or exercised, and fed more on a watery, vegetable Diet; by all which the Crassamentum of the Blood is lessened, and its watery Part increased. Old Age again lessens the Crassamentum, and the gelatinous Part likewise.

From these Principles, but with a conjunct Consideration of the solid Fibres and Vessels, ('Tis a wise Caution of HALLER not to make any Deductions, physiological or therapeutical, unless the conjunct State of the Solids enters the Consideration. The Quantity or Quality of the Blood vitiated or offending are not the primary Causes of slow Diseases, but the Effects of a vitiated State of the Solids, and their Actions by which the Blood and all other Juices are moulded or composed, and to the State of which their Quantity and Quality are answerable; and for this Reason, all learned Professors have proposed the Consideration of the elastic moving Fibres and Vessels, as the necessary Foundation to a Knowledge and Cure of Diseases,) the different Temperaments and morbid Constitutions of People are derived. For a plethoric or sanguine Habit arises from an Abundance of the red Globules. A phlegmatic Temperature is from a Redundancy of the watery Parts of the Blood. A choleric Disposition of the Humours seems to arise from a greater Acrimony and Alcalescence of the Blood, as appears from those  
who

who live on Flesh and on the human Species; being so much fiercer and passionate than those who live on Plants, or on vegetable Food. As for the Melancholy, if there is really such a Humour in the Blood, it seems to consist in a Redundancy of the earthy Principle. (With Respect to the solid Parts a greater Firmness joined with a more exquisite Sensibility or nervous Irritability, dispose to a choleric Habit, and a less Irritability with a moderate Density, to a sanguine Habit, and a lesser Degree both of Density and Irritability are to be referred to a phlegmatic Temperament. In the Melancholy again, a Weakness of the Solids is joined with the highest Degree of nervous Irritation or Sensibility.) But you must be careful not to make these Temperaments as the sole and limited Systems or Classes of Constitutions; which, in the Course of Nature, are found to be not only four, eight, or even thirty two; but are really distinct in numberless Degrees.

The red Parts of the Blood seem chiefly of Use to generate Heat, since they always abound in Proportion to the natural Heat of the Animal. These being confined by the Largeness of the Globules, within the red and first Order of Vessels, hinders the Collapsion of their Extremities, and in receiving the common Motion of the Heat, by the great Density of their Parts, they hold the Motion longer, or make a greater Impetus and Attrition upon the lesser Orders of Humours, upon which their Motion is impressed. And hence it is, that the red Part of the Blood, being too much diminished by profuse Bleedings, there follows a Stagnation, or lessened Motion of the Humours in the smaller Vessels, whence Fatness, Coldness, Dropsy, &c. By the same Rule also; a due Proportion of the said red Blood is necessary within the Habit, to  
generate

generate and repair new Blood for the Uses of the whole System; for by large Hæmorrhages we see the Blood loses its red or dense Nature and degenerates into a pale serous, or watery State.

The hardening Serum is more especially designed for the Secretions and Nutritions of the Parts, as will be hereafter more apparent. The thinner Juices then secreted have various Purposes, as the Dissolution of the Aliments, the Moistening of the external Surface of the Body and Surfaces of the internal Cavities, to preserve the Flexibility of the Solids, and conduce to the Motion of the Nerves, the Sight, &c.

Therefore Health cannot subsist with a dense and red Blood, whose Quantity too much diminished causes a Stagnation or slow ropy trailing of the Juices within the Vessels, whence Cachexy or Paleness, Coldness, Weakness or the like: For on the other Hand can Life or its proper Offices be carried on, or Health subsist without a Sufficiency of thinner Juices intermixed with the red Blood; which being deprived of its watery Part, congeals and obstructs the smallest Passages of the Vessels, and kindles to a great Heat.

If it be asked whether there be any Difference betwixt the arterial and venal Blood, we answer, that some Difference there seems to be, the former having lately passed the Action of the Lungs. But in Experiments, I scarce find any observable Difference either in Colour, Density, or any other known Diversity; for the Circulation is very quick, and the venal Blood itself was but a little before arterial. (However the venal Blood is apparently of a more bright or splendid red, and having a greater Degree of Fluidity and Proportion of watery Parts, may so far differ from the venal darker coloured

loured Blood. But, in this Respect, it remains that we make further Experiments.)

From one and the same Mass of Blood, driven into the Aorta, are generated all the Juices or Humours of the human Body, which, from their Obliquity one to another, are reducible to certain Classes following; but the Manner or Artifice by which each of them are separated, ought to be accounted for by the Fabric or Mechanism of the Glands themselves. HALLER *Linea Prim. Phys.*

As the Blood runs quicker, and into Co-mixture in the Veins, as it comes nearer the Heart, so its Particles move more slowly towards a Separation in the Arteries, as they get farther from the Heart with a diminished Impulse. Thus the Motion of the Blood in the arterial and venal Vessels may be, in general, compared to a Body ascending perpendicularly, contrary to the Force of Gravity, by some Impulse, and with a Momentum or Celerity continually lessening, and then returning or descending with a Celerity perpetually increasing; only in the Blood, this Retardation and Acceleration are neither made uniformly, nor in any certain or regular Proportion, with Respect to the Distances from the Heart, because the Diversity of Strength, Ramification, Convolution, &c. of the Vessels themselves, in which it moves, is irregular and unlimited.

#### OBSERVATIONS.

We see hence, that too much or too little Motion of the Blood will, either of them, cause a morbid Acrimony; the first in a little Time, as in Fevers; and the last in a longer Time, as in Cachexies, Scurveys, &c. In the Fevers, which begin without any dissolving Contagion, as well as in too much or long continued hard Labour, the  
Blood

Blood runs on from the Beginning toward the Height, through various Degrees of inflammatory Tenacity, i. e. to say, the more thin and aqueous Part being gradually thrown out by the fluid Secretions, the nutritious Albumen or Glue, in the Blood, which forms a sort of Crust round the Surface of each Globule, becomes so thick and tenacious, that they join more strongly together into Cohesions, unless kept under by Motion; but the same Degree of Motion or Impetus will make those Globules keep changing their Points of Contact longer, which have the greater Density, i. e. the red ones, consequently the small pellucid Globules will, in this Case, from their less motive Power, and from their greater Surface, which augment the Attraction of Cohesion, first run into filamentary Concatenations; for when the Attraction of Cohesion is increased to a certain Degree, their spherical Figure will, in all Points of Contact, be depressed like fattened Cakes, and that more or less in various Degrees, proportionably to the fewer saline, watery, &c. Particles, which interpose and prevent their closer Cohesion. This will account both for the Production, Increase, and Degrees of Toughness in the Pleuritic inflammatory Crust of the Blood, which is even an Attendant, more or less, upon an accelerated Circulation through the whole System, or only some particular Part, from Pain particularly provided, there is at the same Time, no saline, putrid, or dissolving Acrimony in the Mass.

The End of the first VOLUME.













